

Psychiatric Predictors of Violent Traumatic Brain Injury: Results from the TBIMS Study

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Introduction and Aim

Traumatic brain injury (TBI) is a highly prevalent neurological condition which poses a substantial global public health burden.

It is estimated that nearly **50%** of the global population will sustain a TBI during their lifetime.¹

Violence is the **third most common cause of TBI**,² and socially disadvantaged populations are especially at risk of violence-related TBI.

Prior research indicates a greater risk of violent injury compared to nonviolent injury for various sociodemographic factors;³ however, the influence of psychiatric illness has not been comprehensively examined.

In this study, we aimed to assess the relationship between psychiatric illness and cause of injury in a sample of patients with moderate-severe TBI.

- Are there differences in injury mechanisms among individuals with and without a documented history of psychiatric illness and substance misuse?
- Do these associations persist after accounting for demographic and social variables?

Datasource



The **TBI Model Systems National Database (TBIMS NDB)**⁴ is the largest prospective longitudinal study of moderate-severe TBI (msTBI) in the world. It enrolls participants who receive acute care and inpatient rehabilitation at 16 federally funded TBIMS centres across the United States.

References

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²Maas, A. I. R. et al. Traumatic brain injury: progress and challenges in prevention, clinical care, and research. *Lancet Neurol* 21, 1004–1060 (2022).
³Hanks, R. A. et al. Violent traumatic brain injury: Occurrence, patient characteristics, and risk factors from the traumatic brain injury model systems project. *Arch. Phys. Med. Rehabil.* 94, 249–254 (2003).
⁴Traumatic Brain Injury Model Systems Program. Traumatic Brain Injury Model Systems National Database. <https://doi.org/10.17605/OSF.IO/AXXZB> (2025).

Method

Sample

- Participants of the **TBIMS NDB** aged 16-54 years and newly enrolled in the study between 2013 and 2023

Exposure

- Psychiatric illness prior to the TBI assessed by self-reported utilisation of **psychiatric services** (i.e., **treatment and hospitalisation**) or **suicide attempt**, and **alcohol and drug use** prior to TBI.

Outcome

- TBI aetiology, dichotomised into **violent** (eg, gunshot wound, assault) and **nonviolent** (vehicular incidents, falls, etc) causes of injury

Statistical analyses

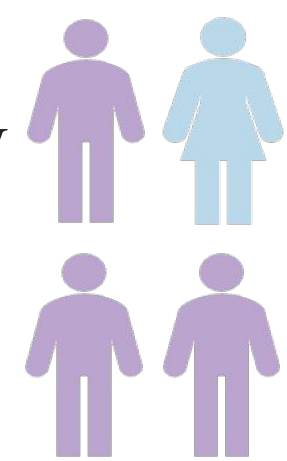
- Logistic regression**, with associations expressed as odds ratios (ORs) and 95% confidence intervals (CIs)

- Minimally adjusted** model: adjusting for age and sex
- Fully adjusted** model: adjusting for age, sex, race and ethnicity, educational attainment, learning and/or behavioural problems in school, employment status, urbanicity
- Age was modelled with restricted cubic splines (3 knots) to allow for non-linear effects
- Missing data was handled using **multiple imputation** by chained equations (20 imputed datasets) under the missing at random assumption
- Data preparation and statistical analyses were conducted in R version 4.5.0.

Results

Total cohort of 5 050 individuals with msTBI

- Mean age of 33.0 (SD, 11.1) years at the time of injury
- Predominantly male (77%) and White (54.1%)



Psychiatric hospitalisation

9.0%

Mental health treatment

23.8%

Suicide attempt

7.3%

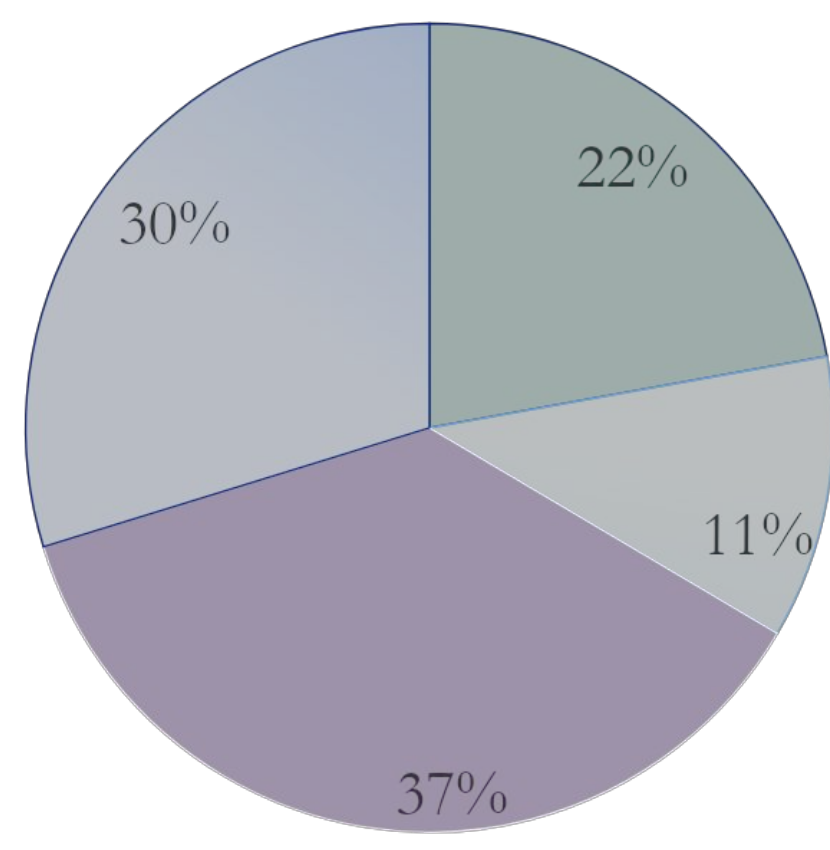
Illicit drug use

27.3%

Heavy alcohol consumption

14.7%

GCS score



■ Mild
■ Moderate
■ Severe
■ Intubated/Sedated

11.7% Violent TBI. Most common violent mechanisms were:

- Gunshot wounds (48.1%)
- Assault with a blunt instrument (40.2%)

Conclusion

Our study found that a history of **psychiatric hospitalisation, mental health treatment, suicidality and illicit drug use increases the odds of violent TBI**, compared to non-violent TBI, even when adjusting for socio-demographic factors.

- Psychiatric vulnerability appears differentially associated with violent mechanisms of injury
- Knowledge of risk factors can inform prevention efforts and improve treatment

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Bluesky

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Risk of violent TBI in individuals with a history of psychiatric illness or substance use compared to controls in the imputed data (n = 5 050)				
Psychiatric illness or substance use	Nonviolent TBI (n = 4 460)	Violent TBI (n = 590)	Minimally adjusted model aOR (95% CI)	Fully adjusted model aOR (95% CI)
Psychiatric hospitalisation	381 (8.5%)	76 (12.9%)	1.70 (1.30-2.22)*	1.44 (1.08-1.93)*
Mental health Treatment	1 047 (23.5%)	155 (26.3%)	1.28 (1.05-1.57)*	1.33 (1.07-1.66)*
Suicide Attempt	302 (6.8%)	68 (11.5%)	1.92 (1.45-2.55)*	1.85 (1.37-2.51)*
Illicit drug use	1 153 (25.9%)	224 (37.9%)	1.69 (1.41-2.04)*	1.56 (1.28-1.90)*
Alcohol consumption				
Abstaining (ref)	1 604 (36.0%)	222 (37.5%)	..	..
Light	960 (21.5%)	119 (20.2%)	0.91 (0.71-1.17)	1.09 (0.84-1.41)
Moderate	1 253 (28.1%)	151 (25.6%)	0.80 (0.64-1.01)	1.03 (0.81-1.31)
Heavy	643 (14.4%)	98 (16.7%)	1.10 (0.84-1.44)	1.29 (0.97-1.72)

Note. Data are N (%) and OR (95% CI). *Significant confidence intervals