How Does Traumatic Brain Injury Affect Quality of Life?
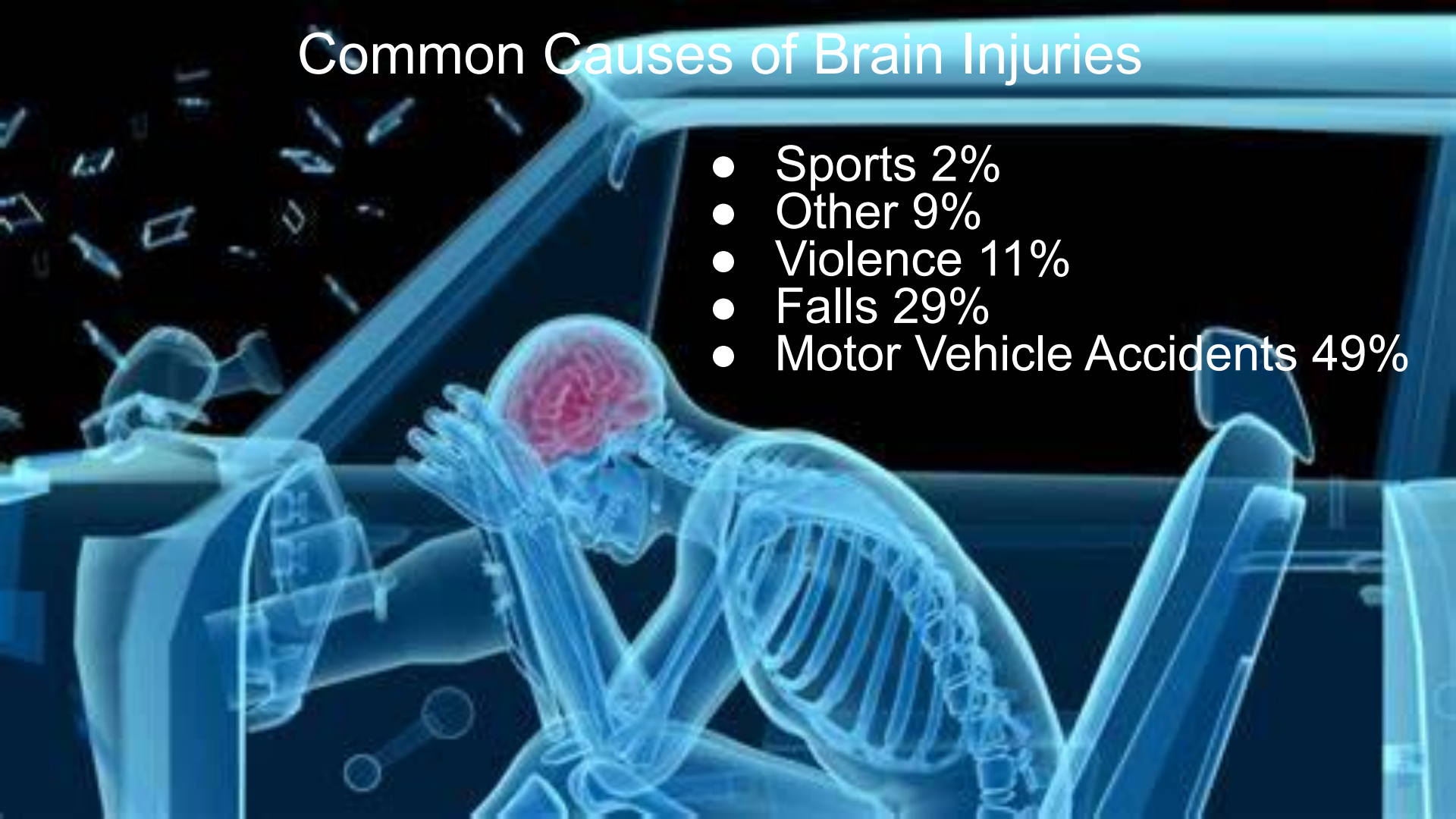
Timothy Hess
Central New Mexico Community College
5/11/23

About Me

- Technical Writing

- Database Development

- Sandia National Labs/Department of Energy

- Data Science Deep Dive

Common Causes of Brain Injuries

- Sports 2%
- Other 9%
- Violence 11%
- Falls 29%
- Motor Vehicle Accidents 49%

How Serious is This?

- Approximately 50 million traumatic brain injuries (TBI) annually worldwide

- Can lead to physical disabilities and cognitive, emotional, and behavioral changes

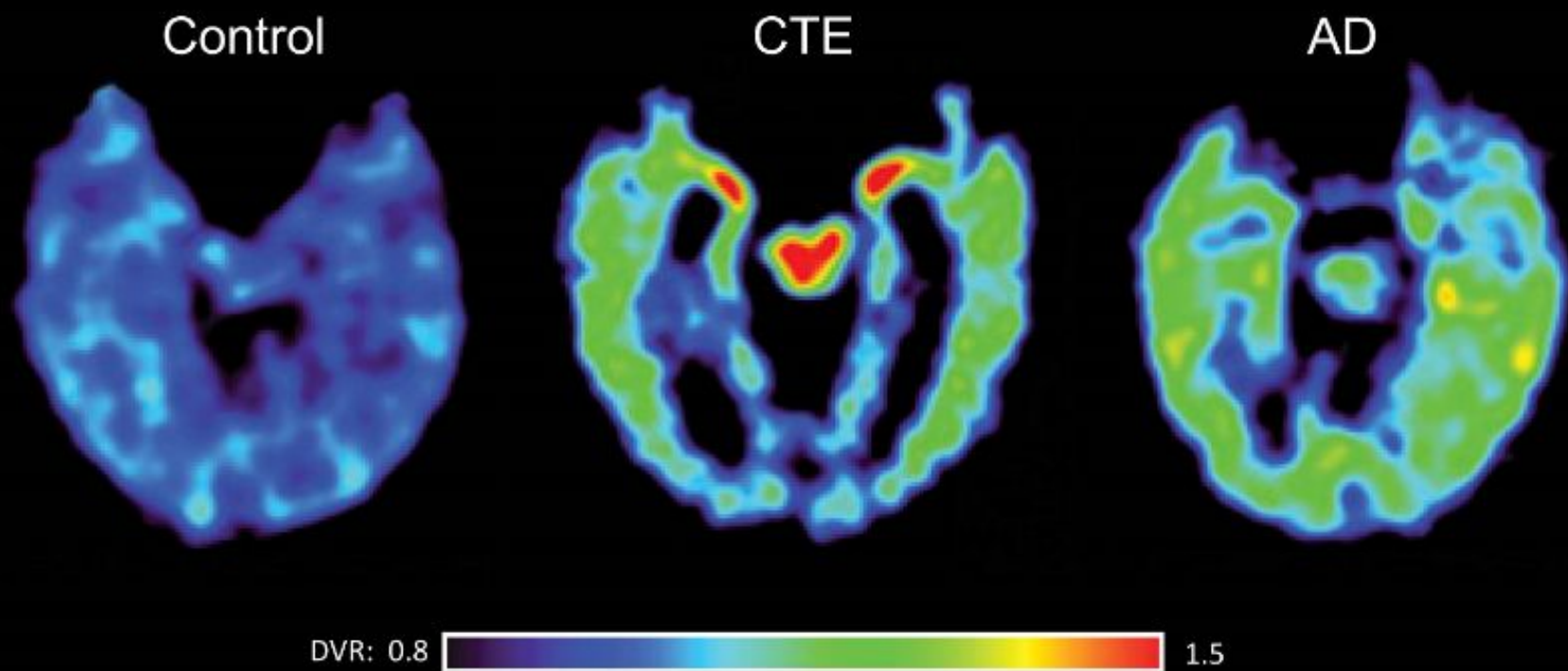- Risk factor for dementia and other chronic medical conditions
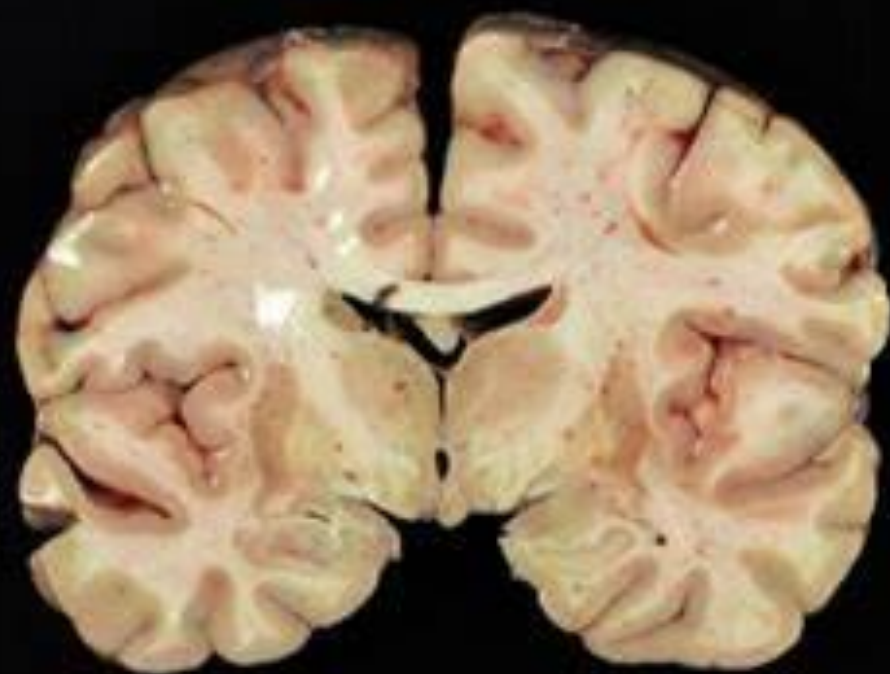
Normal Brain

Advanced CTE

Caption: Left to right, brain PET scans of healthy control; former NFL player with suspected chronic traumatic encephalopathy (CTE); and person with Alzheimer's disease (AD). Areas with highest levels of abnormal tau protein appear red/yellow; medium, green; and lowest, blue.

The Data

- The Traumatic Brain Injury Model Systems National Data and Statistical Center (TBINDSC) located at Craig Neuro-Rehabilitation Hospital in Englewood, Colorado

- Largest database in the world for traumatic brain injury

- Public use dataset does not contain any HIPAA identifiers

Tools
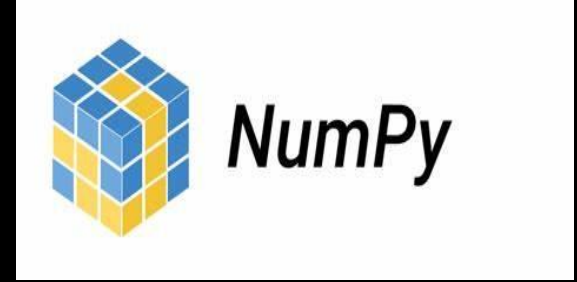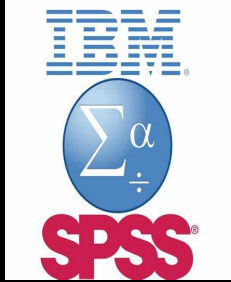
Initial Data Analysis

Two Datasets:

- Form 1
  - Collected upon intake
  - Includes subject history and demographic variables
  - Comprised of 18,679 rows × 343 columns
- Form 2
  - Longitudinal study
  - Follow-up data collected post-injury: 1, 2, 5, 10, 15, and every 5 years thereafter
  - 30 years of treatment outcomes
  - Comprised of 69,138 rows × 292 columns

Additional Data Sources

9 documents were reviewed from a curated list of 167 clinical publications from *Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program*. Lancet Neurol 2023; published online April 19, 2023

Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program

Kristen Dams-O'Connor, Shannon B Juengst, Jennifer Bogner, Nancy D Chiaravalloti, John D Corrigan, Joseph T Giacino, Cynthia L Harrison-Felix, Jeanne M Hoffman, Jessica M Ketchum, Anthony H Lequerica, Jennifer H Marwitz, A Cate Miller, Risa Nakase-Richardson, Amanda R Rabinowitz, Angelle M Sander, Ross Zafonte, Flora M Hammond

Traumatic brain injury (TBI) is a global health priority, associated with substantial burden. Historically conceptualised as an injury event with finite recovery, TBI is now recognised as a chronic condition that can affect multiple domains of health and function, some of which might deteriorate over time. Many people who have had a TBI remain moderately to severely disabled at 5 years, are rehospitalised up to 10 years post-injury, and have a reduced lifespan

Article Categories

- General

- Sleep and Fatigue

- Employment

- Mood (Anxiety, Depression, etc.)

- Life Satisfaction

Variable Selection

Common features among articles:

1. Satisfaction With Life Scale (SWLS)

    Four question evaluation where the patient rates satisfaction with life at the time of the follow-up

2. Patient Health Questionnaire (PHQ)

    Nine question patient self-report used as a screening tool for depression
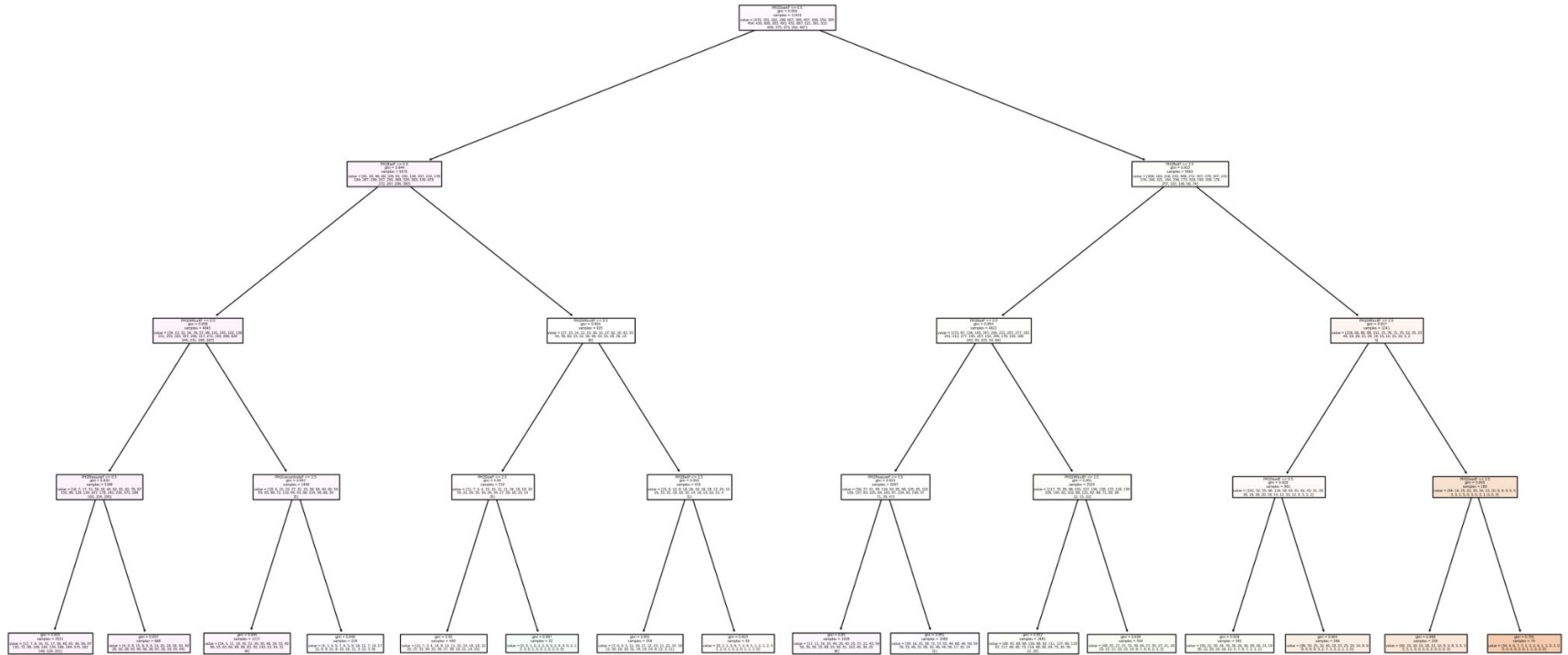
Question

Can we predict a person's quality of life using Satisfaction With Life Scale (SWLS) and Patient Health Questionnaire (PHQ) scores?
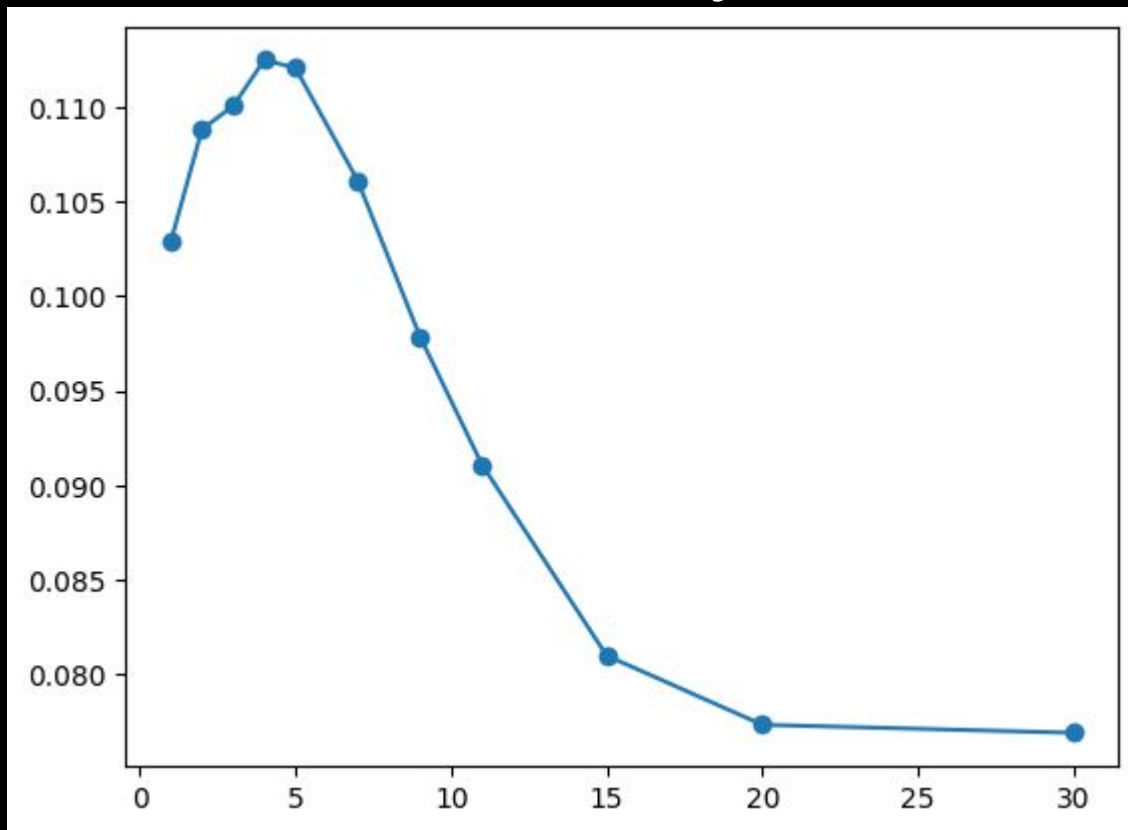
Exploring the Data

- Data Format

  - Comma Separated Values (CSV, XLS)

  - Statistical Package for the Social Sciences (SPSS, SAV)

- CSV and SAV data sets contain identical information, however SPSS data was imported to retain metadata relationships, which are not retained in the CSV format.

Decision Tree

Accuracy

Confusion Matrix (Ideal)

Confusion Matrix (Actual)

Conclusion

- Satisfaction With Life Scale (SWLS) and Patient Health Questionnaire (PHQ) were selected from 292 variables, and evaluated to determine if quality of life of patients with traumatic brain injury can be predicted

- The model had an 11% accuracy rate, indicating that PHQ is a poor predictor of the impact of traumatic brain injury on quality of life (SWLS)

Next Steps

- Analyze the data further:
  Further analyze the data by studying additional papers to identify the target and features used, and comparing statistical models to machine learning models to see if outcomes differ

- Utilize PyCaret:
  Identify additional features that may better predict Satisfaction with Life Scale (SWLS) to determine the optimal features and machine learning model

Questions?

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LinkedIn: www.linkedin.com/in/tw-hess

Github: https://github.com/TWHessNM

Image Credits

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Additional Sources/Publications

9 documents were selected from a curated list of 167 clinical publications from:

[Supplement to: Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program. Lancet Neurol 2023; published online April 19, 2023](#)

General

- [Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program](#)
- [Supplement to: Traumatic brain injury as a chronic disease: insights from the United States Traumatic Brain Injury Model Systems Research Program. Lancet Neurol 2023; published online April 19, 2023](#)

Additional Sources/Publications

Sleep and Fatigue

- [Factors associated with remission of post-traumatic brain injury fatigue in the years following traumatic brain injury](#)
- [Factors associated with remission of insomnia after traumatic brain injury](#)

Mood (anxiety, depression, suicidality)

- [Prevalence of suicidal behaviour following traumatic brain injury: Longitudinal follow-up data from the NIDRR Traumatic Brain Injury Model Systems.](#)
- [A longitudinal study of major and minor depression following traumatic brain injury](#)

Additional Sources/Publications

Employment

- [US Population Estimates of Health and Social Outcomes 5 Years After Rehabilitation for Traumatic Brain Injury](#)
- [Differences in employment outcomes 10 years after traumatic brain injury among racial and ethnic minority groups.](#)
- [Unemployment in the United States after traumatic brain injury for working-age individuals: prevalence and associated factors 2 years postinjury](#)

Life Satisfaction

- [Refining understanding of life satisfaction in elderly persons with traumatic brain injury using age-defined cohorts: a TBI Model Systems study.](#)
- [Trajectories of life satisfaction after traumatic brain injury: Influence of life roles, age, cognitive disability, and depressive symptoms](#)