

Concussion and Traumatic Brain Injury Secondary to Domestic, Intimate Partner and Family Violence

Edie E. Zusman, MD, MBA, FACS, FAANS
Neurosurgeon
Director, TBI and Concussion Research
Piedmont Neuroscience Center
CEO SafeLivingSpace.org

Piedmont Neuroscience Center and Safe Living Space

Piedmont Neuroscience Center

Edie Zusman, MD, MBA
Joshua Kuluva, MD
Erica Dellenbach, BS

SLS Board of Directors

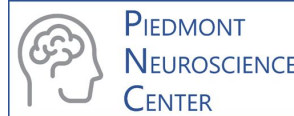
Edie Zusman, MD, MBA
Judy Robinson
Catherine Ndungo-Case

Adam Pratt
Stacie Buchanan, MSW

SLS Advisory Board

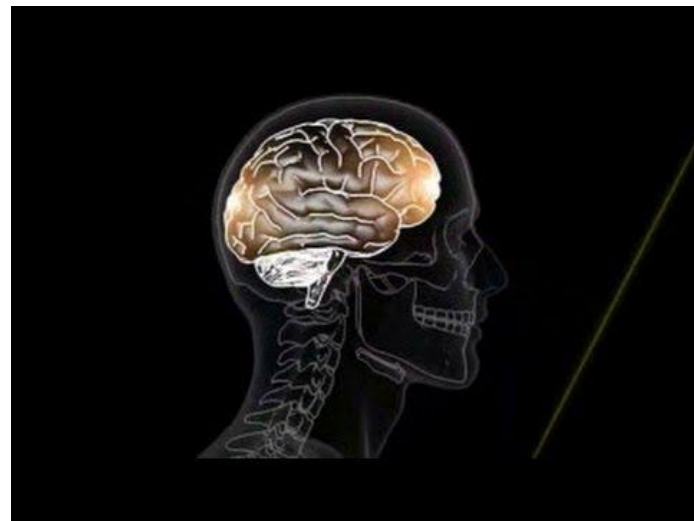
Jahmal Miller, MHA
Jessica Almgren-Bell, BS
Elliott Block, DO
Jordan Glassman, BS
Suzannah Henderson, BS
Rebecca Hendrickson, RN
Gretchen Hess, MA, MS
Kasey Holbert, BS
Katherine Kaffka, MSW
Jonathan Karpa
Wendy Wood-Kjelvik, RN

Joshua Kuluva, MD
Saint-Aaron Morris, MD
Loc Nguyen, MD
Jane A. Petro, MD
Rachel Plouse, BS
Andrew Reisner, MD
Becky K Reiter, RN
Heather Theaux, RN
Nanci Tucker, MD
Yuriy Vinokur, MD
Jerrod Woo, BS
Erica Dellenbach, BS



Concussion and Traumatic Brain Injury (TBI)

- Sudden trauma causing damage to the brain
- Classified as mild, moderate, or severe - **Continuum**
- Event can be associated with or without loss of consciousness - **Anterograde Amnesia**
- Immediate symptoms may include:
 - Confusion/ disorientation - **Competency**
 - Memory difficulty
 - Behavioral/mood changes
 - Blurred vision
 - Lightheadedness/dizziness
 - Headache
 - Fatigue/lethargy
- Long term - Alzheimer's, dementia, Parkinson's, and CTE



Case 1: Motor Vehicle Accident

Patient demographic:

- Age: 46
- Gender: Cis male
- Ethnicity: White
- Occupation: Former CFO

“Sends wife into Starbucks while he waits in the car as he feels he may hit someone if they get in front of him in the line.”

Injury:

- Motor Vehicle Accident
- Symptoms:
 - Headaches
 - Neck pain
 - Memory problems
 - Balance issues
 - Emotional lability

Case 2: Intimate Partner Violence



Patient demographic:

- Age: 27
- Gender: Cis female
- Ethnicity: Latinx
- Occupation: Pole Dancer

*“Signs and symptoms of concussion often exist with no evidence of external injury - **Invisible.**”*

Injury:

- Pushed out of moving car by boyfriend
- Left orbital & maxillary sinus fractures
- Concussion
- Symptoms:
 - Headaches
 - Memory problems
 - Balance issues
 - Anxiety
 - Depressed mood
 - Difficulty sleeping

TBI and Concussion Clinic Mayo Clinic Network Affiliate – NorthBay

Men wearing sunglasses in clinic are diagnosed with “**photophobia/ light sensitivity.**”

Women wearing sunglasses in clinic are described as “**embarrassed.**”



Example of cognitive bias in healthcare and a social justice issue in our culture

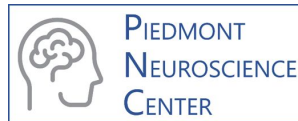
Concussion in Domestic and Intimate Partner Violence

The current landscape of the literature

Concussion/TBI in DV/IPV/FV

Literature Review – Safe Living Space Research Team

Methods: Literature review → identified 55 primary research papers that evaluated concussion and/or TBI within domestic, intimate partner, and family violence populations



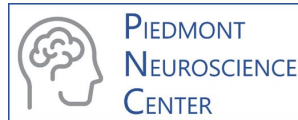
Concussion/TBI in DV/IPV/FV

Literature Review – Safe Living Space Research Team

Results:

In the 55 papers identified...

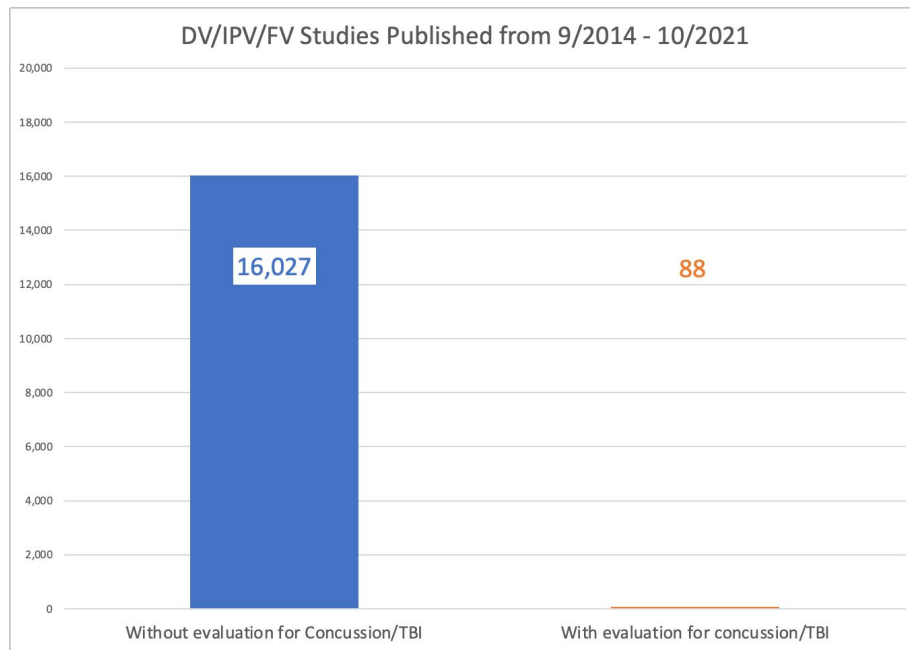
- **100% of studies found patients had sustained concussion and/or TBI**
- Incidence of concussion and/or TBI among DV/IPV/FV victims ranged from **18.8% - 100%**
 - Mean incidence: **58.8%**
- Studies that evaluated patients with concussion and/or TBI: **history of multiple concussions (3+) in 75% - 88% of patients**



Paucity of Research into TBI from DV/IPV/FV

Literature Review – Safe Living Space Research Team

Results: 0.55% of over 16,000 studies included evaluation of concussion and/or TBI.



Concussion from DV/IPV and football

Brain injuries from DV/IPV:

~1.6 million in the US per year (Valera)

Concussion/brain injury from football:

NFL: 187 in 2021 (preseason + regular season)

College football: 166 in 2015

Hillstrom, 2022

NFL, 2022

Bella, 2015



Intimate partner violence causes more concussions than football



No difference in sports concussion metrics

Concussion from domestic
and intimate partner violence

=

Concussion from sports injury

Binomial Logistic Regression

Model Fit Measures

Model	Deviance	R ² _{McF}	Overall Model Test		
			χ ²	df	p
1	44.1	0.149	7.71	5	0.173

Model Coefficients - DV/PV?

Predictor	Estimate	SE	Z	p	Odds ratio	95% Confidence Interval	
						Lower	Upper
Intercept	-9.46932	5.1340	-1.8444	0.065	7.72e-5	3.29e-9	1.81
PTSD	0.00487	0.3080	0.0158	0.987	1.005	0.549	1.84
PHQ-9	0.07499	0.0708	1.0586	0.290	1.078	0.938	1.24
MMSE	0.12479	0.1539	0.8108	0.417	1.133	0.838	1.53
SCAT-3 Symptom #	0.15349	0.1706	0.8997	0.368	1.166	0.835	1.63
SCAT-3 Severity	-0.00174	0.0196	-0.0886	0.929	0.998	0.961	1.04

Note. Estimates represent the log odds of "DV/PV? = 1" vs. "DV/PV? = 0"

Putting it all together

TBI is occurring in DV/IPV/FV situations

Presentation is the same as TBI by other injury mechanisms

There is no current protocol for concussion screening, evaluation and care

Increasing awareness...

☰ The New York Times Magazine 👤

The Hidden Epidemic of Brain Injuries From Domestic Violence

Research shows that survivors of abuse can sustain head trauma more often than football players. But they are almost never diagnosed.

☰ Los Angeles Times

OPINION

New law doesn't do enough to prevent the violence and abuse women face behind closed doors



Angelina Jolie, who lobbied Congress to renew the Violence Against Women Act, is greeted by Sen. Lisa Murkowski (R-Alaska) after a Feb. 9 news conference on the updated law. (Kent Nishimura / Los Angeles Times)

BY ROBIN ABCARIAN | COLUMNIST

MARCH 20, 2022 3:10 AM PT

Symptoms and Sequelae of Injuries to the Head and Neck

Concussion and Strangulation

Symptoms of Concussion

In addition to commonly recognized symptoms...

- Amnesia surrounding event → difficult to take statement
- Memory difficulty → could forget appointments
- Difficulty multitasking and maintaining attention → losing job
- Impaired decision making → contributes to difficulty finding safe housing

Immediate Risks Associated with Concussion

- **Second Impact Syndrome**
 - Second concussion before complete recovery from first
 - Risk of permanent brain injury and death

Return to play guidelines in sports

- Player is removed from the game to prevent second impact syndrome/ repeat concussion
- Prevention of long-term risks for multiple concussions (3-4 or more lifetime)

Should concussed victims be removed from a risky environment to minimize likelihood of sustaining second impact syndrome/ repeat concussion?

Signs/Symptoms of Strangulation

Those who experience DV/IPV also at risk for strangulation...

Physical Symptoms:

- Petechiae in the skin, conjunctive, and/or mucosal surfaces
- Contusions
- Ligature marks from use of an object
- Loss of consciousness
- Loss of bowel or bladder control
- Swelling of the airway or neck
- Difficulty breathing or swallowing

Neurologic effects due to anoxia, or lack of oxygen, may not be distinguishable from those due to concussion.

Neck, throat, and neurologic injuries intensify with repeat episodes of strangulation.

Strangulation as a precursor to DV Homicide

- In **43% of homicides** in DV/IPV, there was prior history of strangulation
- DV/IPV with history of strangulation → high risk factor for death
 - Women who had been strangled even once were **7.5x more likely** to become a homicide victim
- Most do not have physical injuries upon examination by police officer

Unknown whether concussion, whiplash, and traumatic brain injury precede strangulation events and/or are also associated with homicide.

Identifying Victims of Concussion and Strangulation

Concussion:

- **Contusions - marks on the skin**
- **Neurologic effects:**
 - Loss of consciousness
 - Loss of memory
 - Headaches
 - Dizziness
- **Nausea/vomiting**
- Difficulties with balance and/or coordination
- Double vision/blurred vision
- **NO VISIBLE SYMPTOMS**
 - Mechanism of injury
 - Concussion screening

Strangulation:

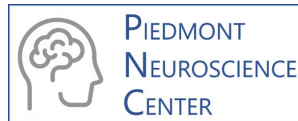
- **Contusions - marks on the skin**
- **Neurologic effects:**
 - Loss of consciousness
 - Loss of memory
 - Headaches
 - Dizziness
- **Vomiting**
- Petechiae
- Scratch/ligature marks
- Difficulty breathing or swallowing
- Sore throat and/or hoarse voice
- **NO VISIBLE SYMPTOMS**
 - Mechanism of injury
 - Concussion/ strangulation screening

Importance of Early Identification and Diagnosis

- **Repetitive injury to the head/neck** → short term effects and increased risk of long term sequelae
- Decrease risk of sustaining multiple injuries to the head and neck through safe placement when possible

Screening and early identification

- **Who:** DV shelter workers, advocates, public health officers, law enforcement, first responders, clinicians/emergency departments/women's health/primary care



Concussion Treatment and Care

The pathway of care after diagnosis

1. Identification/diagnosis of concussion
2. Concussion treatment (modeled after return to play guidelines)

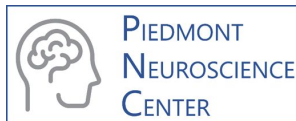
Medical care

Psychological care

Social support

Education

Medical care for concussion in addition to other services that are currently provided





Thinking back to Case 2...

Used sports concussion protocols as framework for discussion

“If you had sustained this injury in a soccer match, we would remove you from the game.”



Patient stayed with her mother to avoid additional injury and reduce risk of second impact syndrome and multiple concussions

Case 2 continued...

Pathway of Care



Interventions/treatments

- Initial decrease in activity levels followed by stepwise increase once other symptoms improved
- Medications prescribed to assist with sleep and headaches
- Physical therapy and psychiatry

Time elapsed since head injury	1 week	3 months	7 months
PHQ9 (0-27)	17	8	3
PTSD (0-5)	5	3	2
SCAT3 symptom number (0-22)	16	11	9
SCAT3 symptom severity (0-132)	45	16	15

Outcomes: Progress was seen on each TBI and concussion metric over time with treatment. While she initially considered returning to her partner, patient reported that her decision changed as her “head cleared”.

First Responder Concussion Screening Tool

Safe Living Space

About the tool:

- 10 questions
- Mixed cognitive and symptomatic assessment with physical exam
- Administered by a third party (first responder, police officer, social worker, DV shelter, etc.)
- Medical care advised based on score

	Correct	Incorrect
1. What city/town are you in?	<input type="checkbox"/>	<input type="checkbox"/>
2. What time of day is it?	<input type="checkbox"/>	<input type="checkbox"/>
3. Who is the current president of the United States?	<input type="checkbox"/>	<input type="checkbox"/>

Access the tool:





Safe Living Space

First Responder Concussion Screening Tool: Suspected Intimate Partner and Family Violence

	Correct	Incorrect
1. What city/town are you in?	<input type="checkbox"/>	<input type="checkbox"/>
2. What time of day is it?	<input type="checkbox"/>	<input type="checkbox"/>
3. Who is the current president of the United States?	<input type="checkbox"/>	<input type="checkbox"/>
4. How many symptoms does the patient have? - Headache - Nausea/Vomiting - Blurred or Double Vision - Amnesia - Dizziness - Sensitivity to Light or Sound	<input type="checkbox"/> ≤2	<input type="checkbox"/> ≥3
5. How many concussions has the patient sustained in the last 12 months?	<input type="checkbox"/> ≤2	<input type="checkbox"/> ≥3

6. The patient shows NO visible signs of strangulation or trauma to the head/neck area.
7. The patient is able to hold up two fingers with the left hand and touch the right ear with the right hand.
8. When assessing pupil shrinkage by shining a flashlight into both eyes, both pupils shrink equally.
9. When moving your finger horizontally across their field of vision, the patient can follow with no blurred or double vision.
10. When the patient stands with their feet together, eyes closed, and arms extended, they are able to maintain their balance.



Total:



Consider Medical Attention For 2 or More **Incorrect** Answers

First Responder Concussion Screening Tool

Safe Living Space

Concussion Self-Screening Tool

This tool is intended to be used by those who believe they may have sustained a concussion. We encourage you to bring this form with you to your next visit with your healthcare team.

Please note, this tool is intended to educate individuals and help them assess their risk of experiencing a concussion. This tool does not diagnose concussion.

[View Tool](#)

First Responders Concussion Screening Tool

This tool is intended to be used by first responders to screen individuals for concussion. This tool does not diagnose concussion.

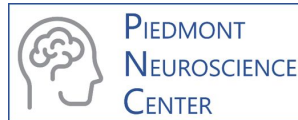
[View Tool](#)

How to access

- Tool is free on SafeLivingSpace.org
- Other resources available
- Feel free to use, modify, and customize our tool—we appreciate all feedback and would be happy to feature your modified version on our site

Coming soon...

- QR code to digitize this and similar resources

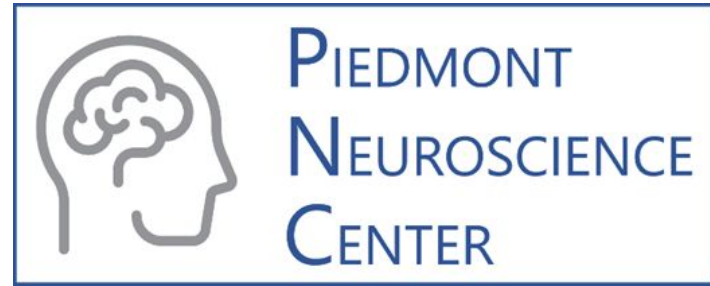


Conclusion

All people who have experienced domestic, intimate partner, and family violence should be screened for concussion and strangulation.

- Concussion is prevalent in DV/IPV, causes serious short- and long-term sequelae, and is clinically the same as concussion from other causes
- Risk for concussion in DV/IPV is understudied and under-recognized, leading to a gap in screening and appropriate pathways to care for this patient population
- Strangulation in DV/IPV has recognized association with homicide and further study will determine whether TBI/concussion is a predictor of escalation
- Detection of concussion and/or strangulation requires providers, officers, and professionals across multiple fields be trained in proper screening and response

Contact: Edie E. Zusman, MD, MBA, FACS, FAANS



 **Safe Living Space**

SafeLivingSpace.org

Edie.Zusman@NeurosciencePartners.org

References

1. Centers for Disease Control and Prevention. (2019, February 12). Concussion danger signs. Centers for Disease Control and Prevention. Retrieved April 17, 2022, from https://www.cdc.gov/headsup/basics/concussion_danger_signs.html
2. Zusman, E. E. 2022, April 29-May 2. *Is there a role for concussion screening for patients who have experienced domestic, intimate partner or family violence?* [Video]. AANS, Philadelphia.
3. Hillstrom, C. (2022, March 1). *The hidden epidemic of brain injuries from domestic violence*. New York Times. Retrieved April 18, 2022, from <https://www.nytimes.com/2022/03/01/magazine/brain-trauma-domestic-violence.html>
4. Bella, T. (2015, December 30). *What have we learned from 500 concussions in 3 years of college football?* Al Jazeera America. Retrieved April 17, 2022, from <http://america.aljazeera.com/watch/shows/america-tonight/articles/2015/12/30/500-concussions-ncaa-college-football-all-reporting.html>
5. NFL. (2022, February 7). *Injury data since 2015*. NFL.com. Retrieved April 17, 2022, from <https://www.nfl.com/playerhealthandsafety/health-and-wellness/injury-data/injury-data>
6. Zusman, E. E. 2021, August 21-15. *Use of Sports Concussion Metrics to Assess Traumatic Brain Injury Secondary to Domestic Violence/ Partner Violence* [Video]. AANS, Orlando, Florida. <https://www.aans.org/meetings//Online-Program/Eposter?eventid=49140&itemid=EPOSTER&propid=53815>.

References (continued)

7. Armstrong M, Strack GB. Recognition and Documentation of Strangulation Crimes: A Review. *JAMA Otolaryngol Head Neck Surg.* 2016;142(9):891–897. [doi:10.1001/jamaoto.2016.0293](https://doi.org/10.1001/jamaoto.2016.0293)
8. Glass, N., Laughon, K., Campbell, J., Block, C. R., Hanson, G., Sharps, P. W., & Taliaferro, E. (2008). Non-fatal strangulation is an important risk factor for homicide of women. *The Journal of emergency medicine*, 35(3), 329–335. doi.org/10.1016/j.jemermed.2007.02.065
9. Strack, G. B., McClane, G. E., & Hawley, D. (2001). A review of 300 attempted strangulation cases. Part I: criminal legal issues. *The Journal of emergency medicine*, 21(3), 303–309. [doi.org/10.1016/s0736-4679\(01\)00399-7](https://doi.org/10.1016/s0736-4679(01)00399-7)
10. Aceves, Y. (Ed.). (2017). Signs and symptoms of strangulation. *Family Justice Center Alliance Signs and Symptoms of Strangulation Comments*. Retrieved April 17, 2022, from <https://www.familyjusticecenter.org/resources/signs-and-symptoms-of-strangulation/>