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Anoxic & Concussive Traumatic Brain Injury from Repetitive IPV: “It’s All One Brain”

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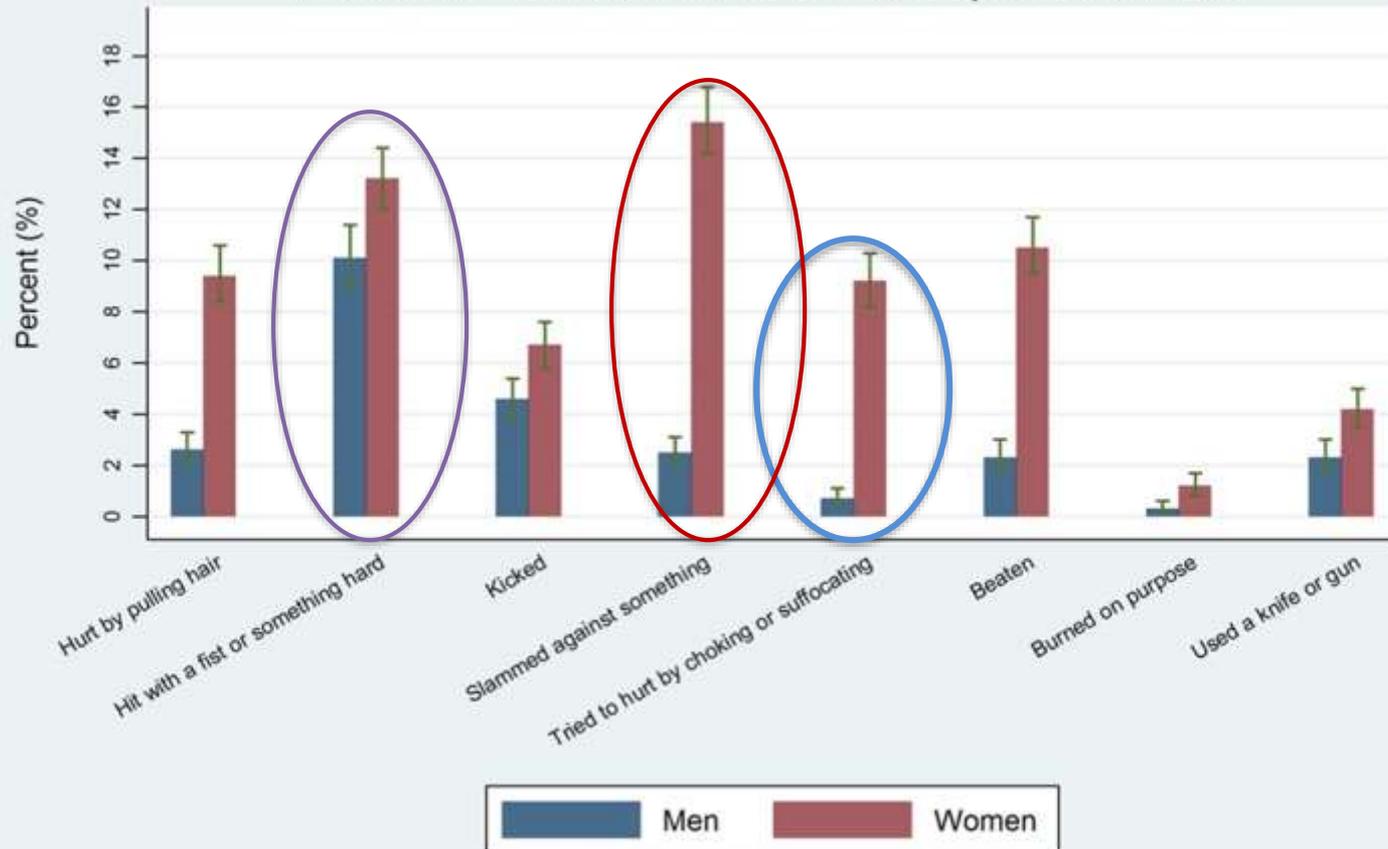
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[.http://online.liebertpub.com/doi/10.1089/jwh.2016.6311](http://online.liebertpub.com/doi/10.1089/jwh.2016.6311)

TBI in Abused Women – from head injury AND/or strangulation

- TBI: “A traumatically induced physiological disruption of brain function, as manifested by at least one of the following: any loss of consciousness; any loss of memory for events immediately before or after the accident; any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused); focal neurologic deficit(s) that may or may not be transient.” (Committee on Mild Traumatic Brain Injury & American Congress of Rehabilitation Medicine, 1993).
- Under this definition AICs following strangulation-induced anoxia/hypoxia as well as following head injury considered TBI’s as contrasted with:
- “TBI is defined as an alteration in brain function, or other evidence of brain pathology, caused by an external force.”
(Committee on TBI from NINDS & NIDRR, VA, DVBIC *Arch Phys Med Rehabil Vol 91, November 2010*)

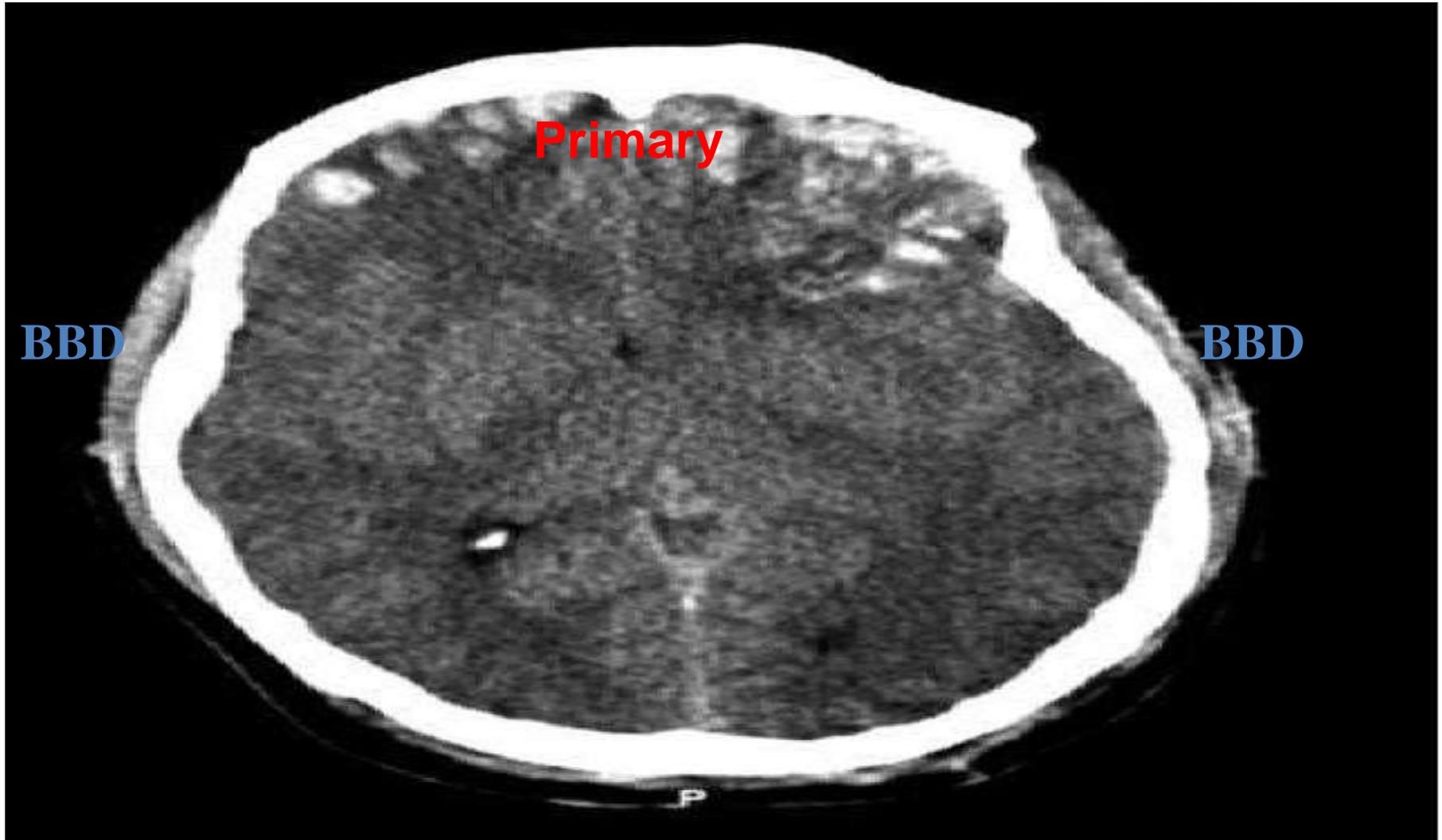
Lifetime prevalence of self-reported severe physical violence, by sex of victim
National Intimate Partner and Sexual Violence Survey, United States, 2011



Generated from Breiding et al. *MMWR Surveill Summ.* 2014 Sep 5;63(8):1-18

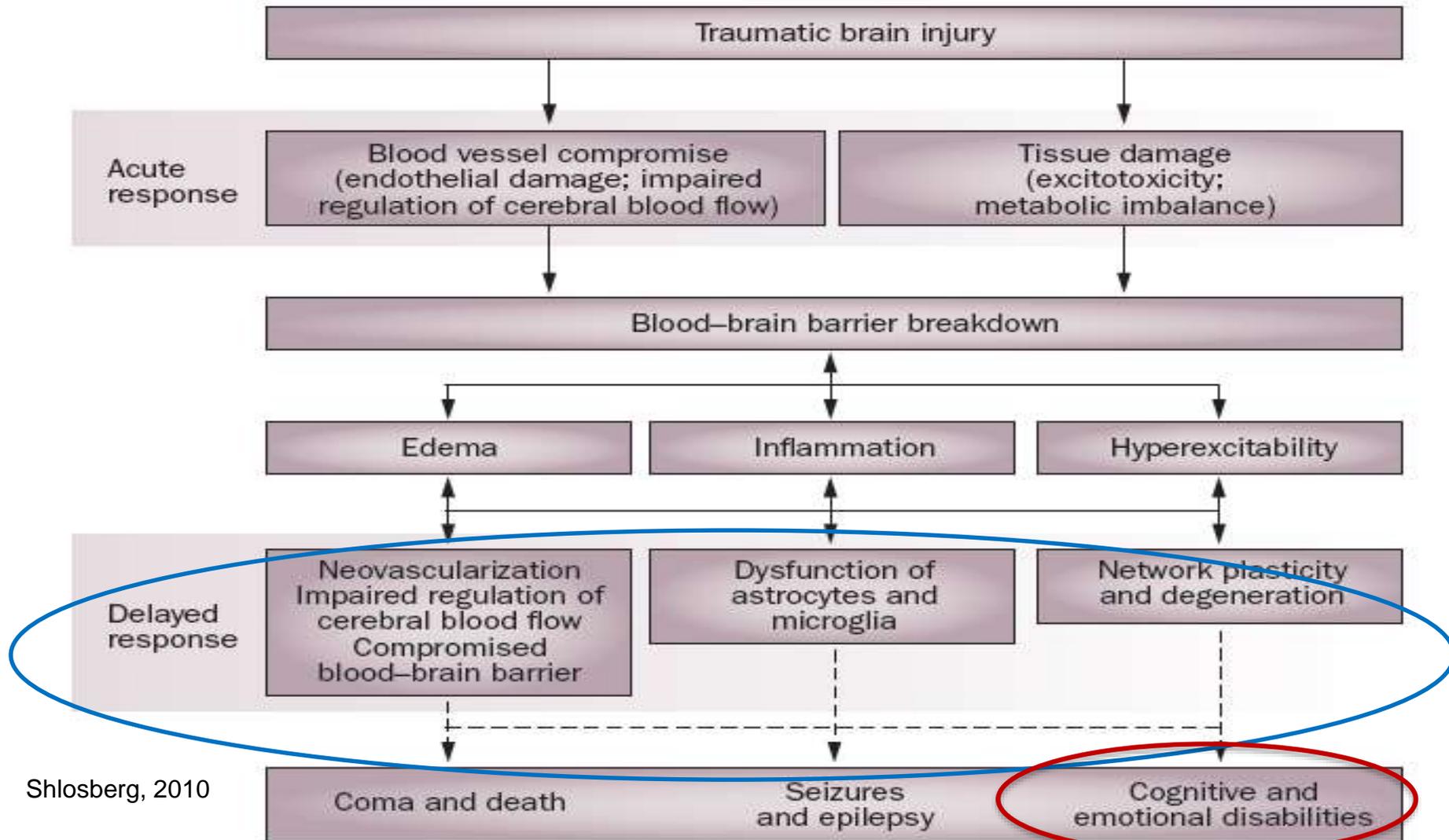
14.8% of women injured; 7.9% needed medical care from IPV – CDC, NISVS, 2015

Image of a Severe TBI



BBD = Blood Barrier Disruption – neuronal damage

Acute and Delayed Response



TBI Vulnerability in Abused Women

- Abused women have higher levels of inflammatory cytokines (Woods et al., 2005; Gill, 2007) – these high levels of inflammatory cytokines may increase vulnerability to TBIs through increased disruption of the blood brain barrier
- Lower levels of neuropeptides in abused women with PTSD, which may impair neuronal repair following TBIs (Kwako et al, 2011)
- Repetitive nature of IPV – multiple violent attacks – shaking, punching in face, ears, often hard enough to break bones – fractured jaws, fractured orbitals, head “slammed” against wall in back of her, strangulation events, over time – often for years – cumulative effects of repeated head injury – similar to what happens to boxers, football players (CTE)

- Abused women significantly more CNS Sx –trouble concentrating, memory px, fainting/dizzy spells) than nonabused (Campbell et al the *Lancet* 2002).
- Strangulation: memory problems, depression, insomnia, headaches, dizziness, and loss of sensation with far greater symptoms in women who reported five or more strangulation events compared to abused women who reported two or fewer events (Smith, Mills et al. 2001).
- Blunt force: TBI often have symptoms including: headaches , dizziness, memory loss , insomnia, depression apathy, and fatigue. (Monahan & O'Leary 1999; Smith, Mills et al. 2001; Wilbur, Higley et al. 2001)



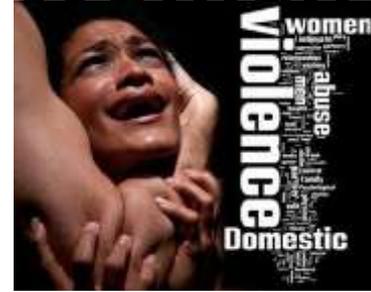
No clinical assessment of all neurocognitive symptoms
No linking with neurological impairments
Do not examine the cumulative impact of TBI' s
Do not control for PTSD and depression symptoms
No neuronal imaging or biomarkers

Strangulation

- **Definition¹**
 - External pressure to the neck that closes blood vessels and/or air passages and deprives person of oxygen
- **Extent of injury depends on:²**
 - Exact anatomical location of applied pressure
 - Amount of pressure
 - Duration of pressure
 - Surface area of pressure zone
- **Pressure for vascular occlusion:³**
 - Less pressure than needed to open a can of soda
 - 2 kg for jugular veins; 5 kg for carotid arteries
- **Loss of consciousness** can occur in 5-10 seconds, death in minutes⁴

¹Sauvageau, 2010; ²Iserson, 1984; ³Training Institute on Strangulation Prevention, 2015; ⁴Huether & McCance,

Intimate Partner Strangulation of Women



- **Prevalence (among all women not just abused)**
 - Global:¹ Lifetime: 3.0%-9.7%; Past-year: 0.4%-2.4%
- **Prevalence among abused women**
 - 54-68% DV shelter/police called samples (Wilbur '01; Sutherland '02; Messing '18)
 - 56% in a national sample of abused women (Campbell et al. 2003) – 10% abused, never almost killed; 50% abused & killed or nearly killed
- **Risk for Fatality: 10.9% of IP Femicides strangled to death (NVDRS)**
 - 43% of women murdered and 45% of women almost murdered by a partner were previously strangled – women report extreme fear³
 - Prior NF-IPS of women increases risk 6.7 (AOR) for attempted homicide 7.48 (AOR) completed homicide³ If strangled LOC or >1 during last year increases risk even more (37.8% of severely abused sample of 1008 women in US multiple strangulation) new Danger Assessment (www.dangerassessment.org) scoring reflects⁴
 - Death may occur from stroke in next 24-72 hours⁵
 - Can be fatal even without any external injuries⁶

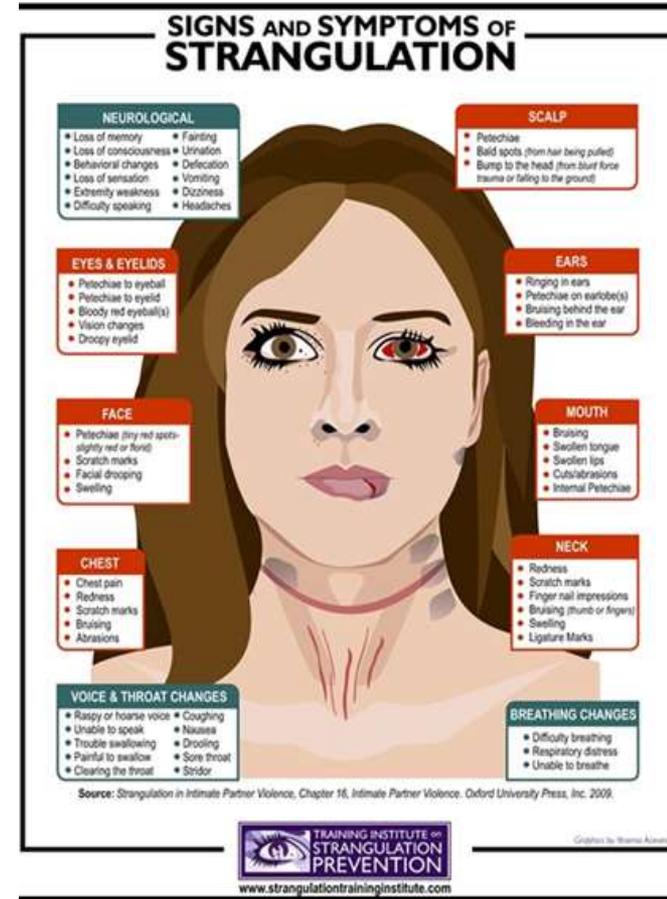
¹Sorenson et al. (2014); ²Breiding et al. (2014); ³Glass et al. (2008); ⁴Messing, Campbell, Snitder, 2017; ⁵Wu et al. (2017);

⁶Hawley et al. (2001);

Non-Fatal Intimate Partner Strangulation (NF-IPS) of Women

<https://www.strangulationtraininginstitute.com>

- Not everyone dies...
 - Potentially devastating health outcomes¹⁻⁶
 - Acute injuries, such as hematomas and loss of consciousness
 - Long-term or delayed presentation injuries, including stroke and PTSD
 - Multiple strangulations associated with increased reports of physical & psychological symptoms⁶, risk of miscarriage⁷
 - 50-90% of those reporting strangulation have no external visible injuries^{8,9}



¹Glass et al., 2008 ²Wilbur et al. (2001); ³Sheridan & Nash (2007); ⁴Valera & Kucyi (2016); ⁵Kwako et al. (2011); ⁶Smith et al., 2001; Cimino et al 2019

⁷Messing et al, 2018; ⁸Srack et al., 2001; ⁹Holbrook & Jackson 2013

2 studies - ACAAWS Study: Methods

- Comparative case-control study (randomly selected controls)
 - Cases – abused – physical &/or sexual &/or psychological if above cutoff on WEB - by an intimate partner lifetime (N = 538) & in past 2 years
 - Controls –never abused by anyone in lifetime (N = 356)
- Eligibility criteria
 - Women 18-55 years
 - Self-identify as African Caribbean or African America
 - Report intimate partner in the past two years
- Women recruited from **primary care, prenatal or family planning clinics** in Baltimore & USVI 2009-2011
- Questionnaire administered on a touch screen computer with optional headphones – ACASI



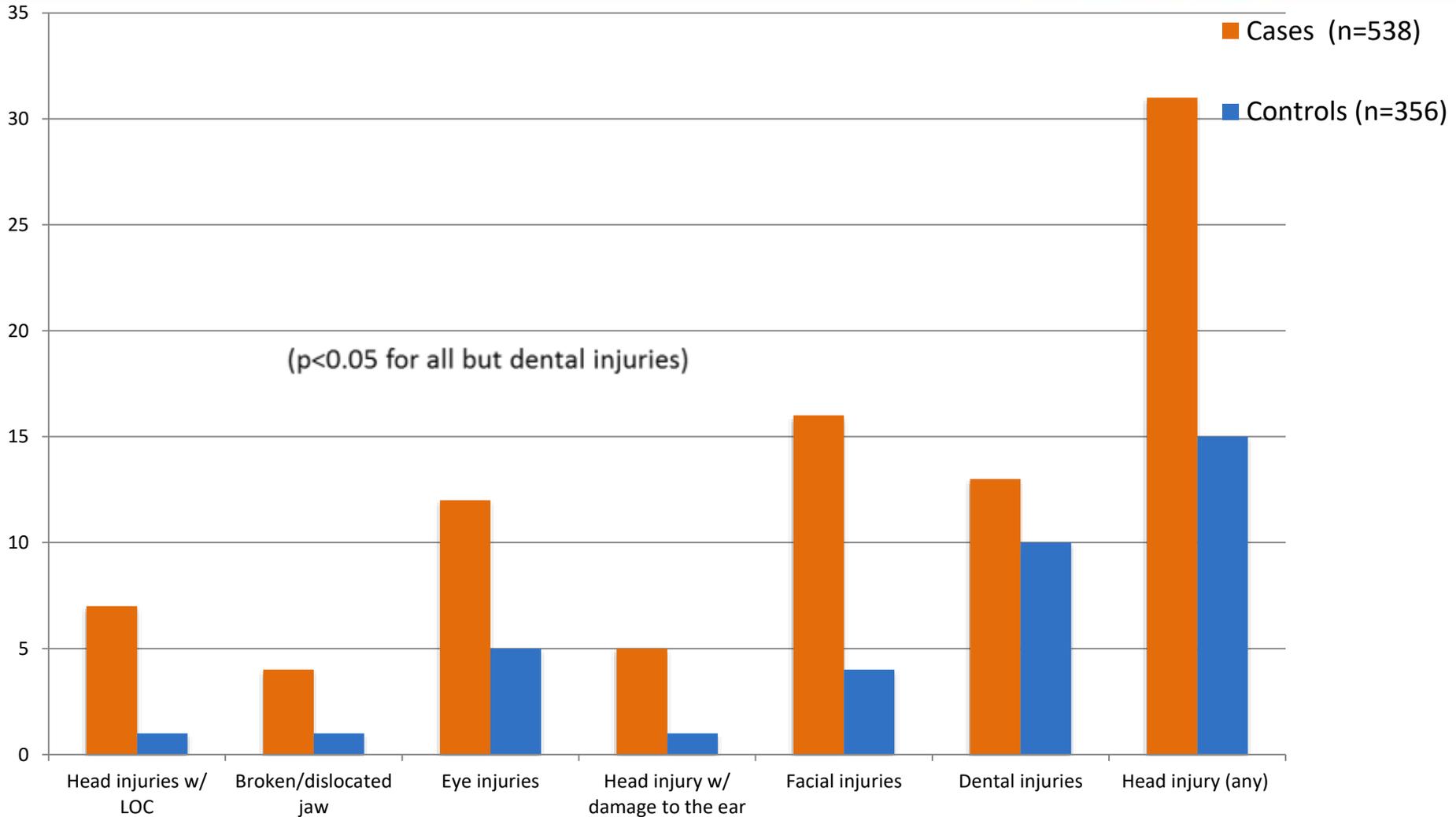
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ACAAWS & WHES MEASURE OF TBI – Yes to any one of the below

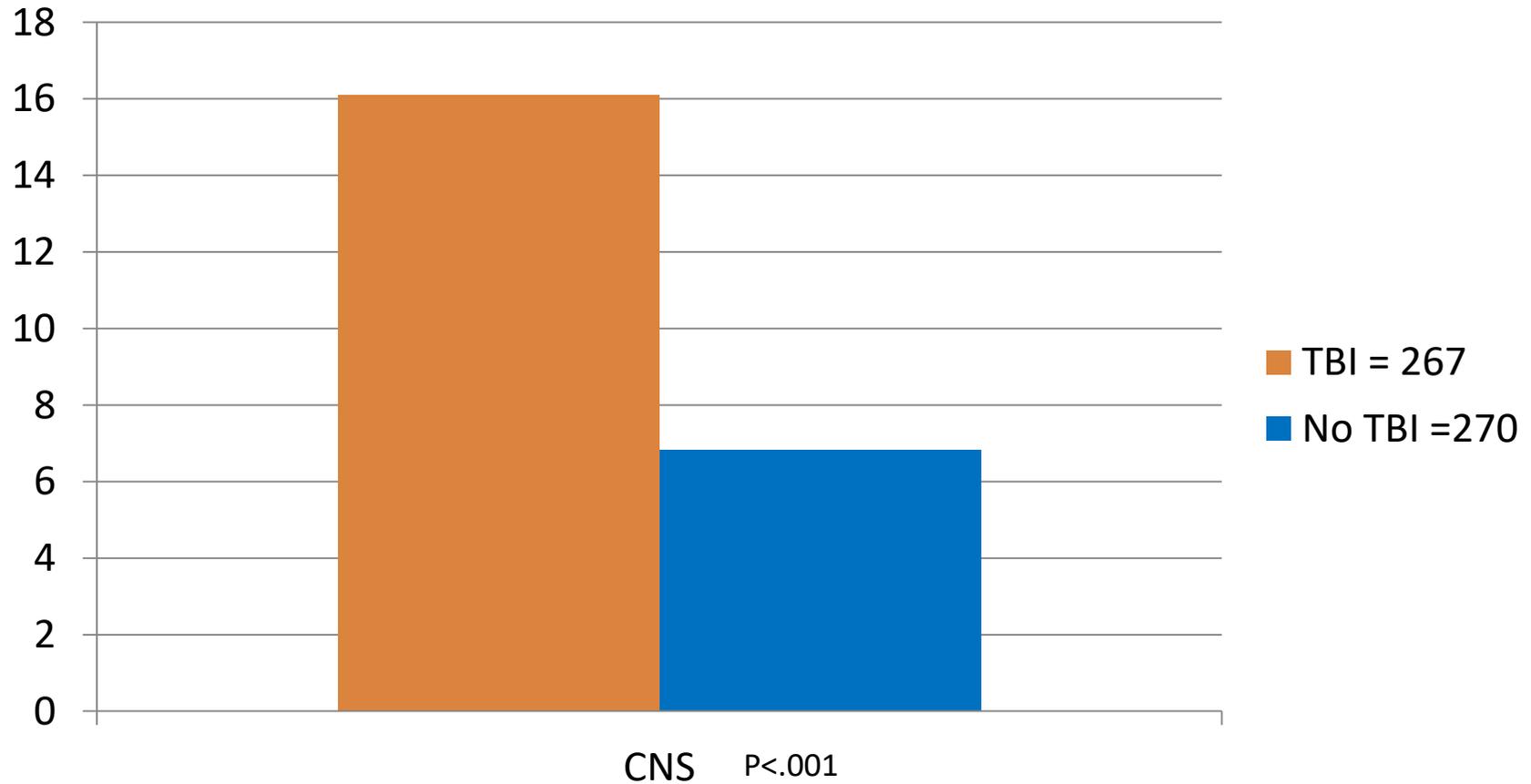
- **In the past year, how many times** has the following happened to you?
 - Head injury with loss of consciousness (better if alteration in consciousness)
 - Broken/dislocated jaw
 - Eye injuries
 - Head injury with damage to the ear
 - Facial injuries (eg black eye, bloody nose)
 - Dental injuries
- In the past 12 months has your partner ever choked you?
- Does he ever try to choke you?
- CNS Sx – past year: Dizzy spells, Memory loss, Difficulty concentrating, Headaches, Blacking out, Seizures, Hearing loss, Ringing in ears, Vision problems (Self Report – MAIPSAIS/PASS in WHES – Women’s Health)



% of Participants Reporting Past Year Head Injuries

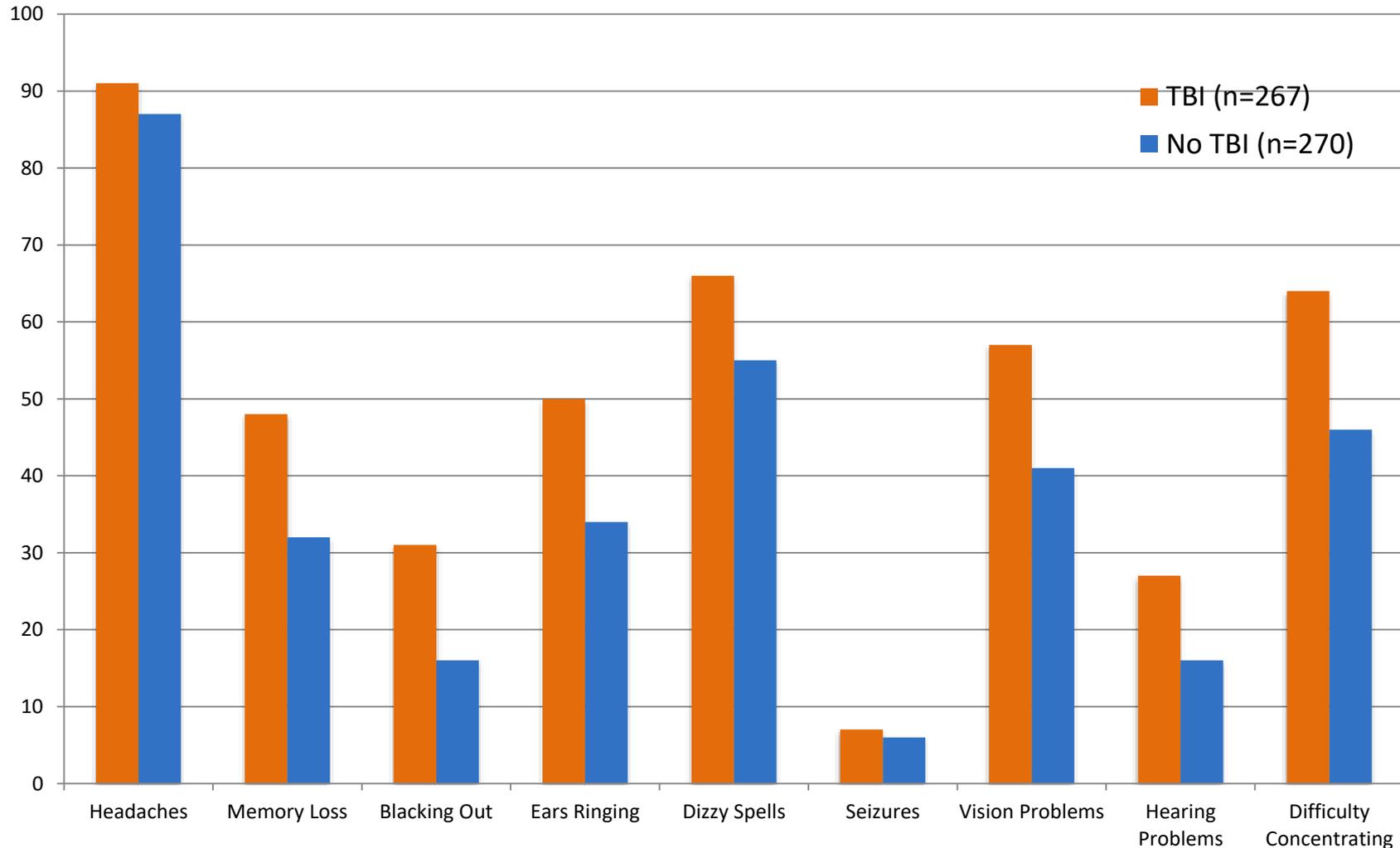


TBI (HI w/LOC &/or Strangulation) CNS Mean Sx Score Among Cases



Among abused women % (Cases) w/TBI Reporting Past Year CNS Symptoms

(all $p < 0.05$ except HA and Seizures)



Associations of covariates with CNS Symptom Frequency Score

	Adjusted Results		
	β	95% CI	P value
TBI	2.79	2.12-3.46	<.001
Positive PTSD screen	2.26	1.31-3.21	<.001
Positive Depression	3.14	2.47-3.82	<.001
Age group 4 (45+)	1.23	.09-2.38	.04
Age group 3 (35-44)	.53	-.38-1.44	.26
Age group 2 (25-34)	-.49	-1.20-.23	.18
Age group 1 (18-24)		Ref	

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Women's Health Effects Study (WHES)

- Longitudinal cohort study - community sample of 309 adult Canadian women, all separated from an abusive partners in the previous 3 years
- Data collected via 5 Structured Interviews: baseline, 1, 2, 3 and 4 years later (Sample retention 81%)
- Measures: wide range of abuse, health, social and economic variables
- For this analysis:
 - Lifetime Injuries Due to IPV (6 types of injury to head)
 - Neurological Symptoms: PASS (formerly MAIPSAIS) frequency subscale (Mean score)

Study Co-leads: Marilyn Ford-Gilboe, Colleen Varcoe, Judy Wuest
Funded by: Canadian Institutes of Health Research (CIHR)



CIHR IRSC

Proportion of Women Reporting Head Injuries by Injury Type at Wave 1

Women's Health Effects Study (N=309)

Type of Injury	N (%) WHES	N (%) ACAAWS
Head injuries with loss of consciousness	89 (28.8%)	40 (7.5%)
Broken/dislocated jaw	34 (11.0%)	22 (4.0%)
Eye injuries	71 (23.0%)	70 (13%)
Head injury with damage to the ear	54 (17.5%)	27 (5%)
Facial injuries (e.g., black eye, bloody nose)	189 (61.2%)	86 (16%)
Dental injuries	51 (16.5%)	75 (14%)

Probable TBI WHES: 65.5% (n = 202)

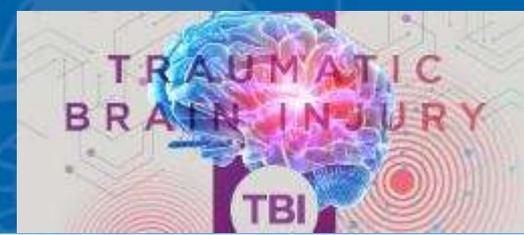
Probable TBI ACAAWS: 50% (n = 267)

Differences in Neurological Symptoms over 4 years by Probable TBI Status at WAVE 1

Women's Health Effects Study (N=309)

	No TBI		Probable TBI		p-value
	N	Neuro Sx Mean (sd)	N	Neuro Sx Mean (sd)	
Wave 1	103	0.50 (0.52)	202	0.91 (0.80)	<.001
Wave2	99	0.76 (0.69)	183	0.91 (0.77)	.097
Wave 3	98	0.60 (0.56)	172	0.82 (0.71)	.010
Wave 4	91	0.54 (0.58)	160	0.84 (0.77)	.002
Wave 5	92	0.55 (0.61)	158	0.84 (0.73)	.002

Differences persist over time (except W2)



- Clearly abused women are experiencing TBI – US, Canada & probably globally – immediate injuries treated but longterm Sx often not treated adequately – CTE (Chronic Traumatic Encephalitis) possible
- Language matters – how ask – “blacked out” (20%) vs. LOC (3.8%) – “trouble concentrating” “memory problems or forgetting things”
- One other study has combined TBI from strangulation &/or head injury in abused women – measurable cognitive problems that also show on scans – longterm effects can be treated by cognitive psychologists – Sx often mirror PTSD but psychotherapy not effective (Valera et al 2017, '18, '19)
- Immediate TBI/concussion ED protocols exist but abused women not often recognized as TBI patients anywhere – must be addressed!
- Health care systems need to screen abused women and adolescents for TBI & CNS Sx – can use MAPSAIS/PASS questions; domestic violence NGO's need to assess for TBI & longterm effects –
 - Ohio Coalition Against Domestic Violence - materials for survivors on TBI & NY State Coalition Against DV TBI protocol
- Abused women without access to high level diagnostic & anywhere can be helped with “work arounds” to address the memory & concentration problems – strategies used for early dementia – EMDR?



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