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ORIGINAL ARTICLE CLINICAL STUDIES

Screening for Brain Injury Sustained in the Context of Intimate Partner Violence (IPV): Measure Development and Preliminary Utility of the Brain Injury Screening Questionnaire IPV Module

Kristen Dams-O'Connor,[1,2,*] Ashlyn Bulas,[1] Halina (Lin) Haag,[3] Lisa A. Spielman,[1] Angela Fernandez,[4] Lynn Frederick-Hawley,[4] Jeanne M. Hoffman,[5] and Yelena Goldin Frazier[6]

Abstract

Intimate partner violence (IPV) is associated with risk for multi-etiology brain injury (BI), including repetitive head impacts, isolated traumatic brain injuries (TBI), and anoxic/hypoxic injury secondary to nonfatal strangulation (NFS). IPV-related injuries are often unreported, but evidence suggests that survivors are more likely to report when asked directly. There are currently no validated tools for screening of brain injury related to IPV that meet World Health Organization guidelines for this population. Here, we describe measure development methods and preliminary utility of the Brain Injury Screening Questionnaire IPV (BISQ-IPV) module. We culled items from existing IPV and TBI screening tools and sought two rounds of stakeholder feedback regarding content coverage, terminology, and safety of administration. The resulting stakeholder-informed BISQ-IPV module is a seven-item self-report measure that uses contextual cues (e.g., being shoved, shaken, strangled) to query lifetime history of IPV-related head/neck injury. We introduced the BISQ-IPV module into the Late Effects of TBI (LETBI) study to investigate rates of violent and IPV-specific head/neck injury reporting in a TBI sample. Among those who completed the BISQ-IPV module ($n = 142$), 8% of the sample (and 20% of women) reported IPV-related TBI, and 15% of the sample (34% of women) reported IPV-related head or neck injury events that did not result in loss or alteration of consciousness. No men reported NFS; one woman reported inferred BI secondary to NFS, and 6% of women reported NFS events. Those who endorsed IPV-BI were all women, many were highly educated, and many reported low incomes. We then compared reporting of violent TBIs and head/neck injury events among individuals who completed the core BISQ wherein IPV is not specifically queried (administered from 2015-2018; $n = 156$) to that of individuals who completed the core BISQ preceded by the BISQ-IPV module (BISQ+IPV, administered from 2019-2021; $n = 142$). We found that 9% of those who completed the core BISQ reported violent TBI (e.g., abuse, assault), whereas 19% of those who completed the BISQ+IPV immediately preceding the core BISQ reported non-IPV-related violent TBI on the core BISQ. These findings suggest that standard TBI screening tools are inadequate for identifying IPV-BI and structured cueing of IPV-related contexts yields

[1]Department of Rehabilitation and Human Performance, [2]Department of Neurology, [4]Department of OBGYN and Reproductive Sciences, Icahn School of Medicine at Mount Sinai, New York, New York, USA.
[3]Department of Social Work, Wilfrid Laurier University, Waterloo, Ontario, Canada.
[5]Department of Rehabilitation Medicine, University of Washington School of Medicine, Seattle, Washington, USA.
[6]Yelena Goldin Frazier Curect Neuropsychology of New York, East Rockaway, New York, USA.

*Address correspondence to: *Kristen Dams-O'Connor PhD, Icahn School of Medicine at Mount Sinai, One Gustave Levy Place, Box 1163, New York, NY 10029, USA E-mail:* kristen.dams-o'connor@mountsinai.org

greater reporting of both IPV- and non-IPV-related violent BI. When not queried directly, IPV-BI remains a hidden variable in TBI research studies.

Keywords: intimate partner violence; traumatic brain injury

Introduction

Intimate partner violence (IPV) refers to coercive, aggressive, or violent acts perpetrated by a current or former romantic or sexual partner, and includes physical, emotional, financial, and sexual violence, and/or stalking to establish and maintain power and control.[1] Both males and females can be victimized, but four in five victims of criminally recorded IPV identify as females.[1,2] Females experience far greater physical injury and service costs than males.[3–6] IPV perpetrators commonly target the head and face,[1,7,8] resulting in brain injury (BI).[9–22] Estimates suggest that up to 75% of women IPV survivors sustain a BI in the context of IPV.[16] IPV-BI can be caused by an isolated traumatic brain injury (TBI, i.e., external force to the head resulting in loss or alteration of consciousness),[23,24] or by nonfatal strangulation (NFS), which refers to any injury that alters cerebral blood flow secondary to manual or ligature strangulation, suffocation, or near drowning,[18] Repetitive head injury (RHI), or repeated exposure to sub-concussive or sub-clinical injuries to the head, neck, or face, can include quantifiable isolated injury events or repetitive abuse that is not easily quantified; RHI. These injury etiologies—TBI, NFS, and RHI—can occur in isolation, or they can co-occur in individuals with a history of IPV.[13,25,26]

Brain trauma sustained in the context of IPV is unique in important ways. Isolated TBI often co-occurs with frequent RHI, which unlike injuries sustained in other contexts (e.g., contact sports), is not followed by medical surveillance or opportunity for rest and recovery. NFS may co-occur with TBI and RHI, particularly as abuse escalates.[27] Barriers to IPV reporting are well-documented; they include fear of retaliation, safety concerns, mistrust of criminal-legal and/or health care systems, feeling they will not be believed, lack of access to health insurance and care, minimization of injury-related consequences, feelings of guilt or shame, and brain injury-related cognitive impairments that can contribute to under-reporting or minimization of violence.[9,13,18,28–31] Some evidence suggests people of color and other marginalized groups may be more reluctant to seek care.[32] Data suggest that fewer than 25% of women who reported an IPV-BI sought medical care[9,13] and only 6% of those who survive NFS were admitted to hospital.[26] In a sample of 345 women who sought emergency department care following NFS, medical codes indicating IPV and strangulation were recorded in only 5.5% of cases.[33] Extracranial injuries, such as fractures, may distract providers from identifying signs of IPV or NFS even in help-seeking individuals.[33] Providers' unfamiliarity with IPV-related codes, poor alignment of codes with reimbursed services, and privacy concerns are barriers to documenting IPV and NFS in medical records.[34] It is clear that medical records cannot be used in isolation to identify IPV-related BI exposure.

Screening for TBI is commonly conducted through structured self-report questionnaires, now recognized as the field standard for clinical and research screening.[35,36] Several widely-used and well-validated tools are available[37–40]; what these tools have in common is the use of contextual cues (e.g., ''on a playground'' and ''in a car accident'') to maximize recall accuracy and completeness of lifetime head trauma exposures.[38] A recent review[35] examined existing self-report TBI screening tools through the lens of World Health Organization recommendations for screening in vulnerable populations, and concluded that only two approximated meeting recommendations for research on violence in women[41,42] and for IPV in particular.[43,44] One such measure is the Brain Injury Screening Questionnaire (BISQ). The BISQ provides 20 contextual cues that query whether a blow to the head was ever sustained in each context. For each positive endorsement, subsequent questions query duration of altered mental status and/or unconsciousness to characterize the severity and year of each event recalled.

The BISQ includes two cues regarding blows to the head sustained in violent contexts, namely while ''being assaulted or mugged'' and ''being physically abused.'' No cues in the 20-item core BISQ are specific to IPV, and some evidence suggests that structured cueing may be especially important in IPV-BI screening. Prior studies indicate that survivors are unlikely to report IPV-related BI when they are not specifically asked[29,45–51]; conversely, many IPV survivors indicate that they would report abuse if asked directly.[52,53] As such, the use of detailed screening questions has been recognized as a key component to successful implementation of IPV screening in clinical settings.[33,45]

To date, the utility of IPV-specific recall cues has not been examined in the context of IPV-related BI. Here, we describe the methods we used to develop and refine the BISQ-IPV module and provide preliminary evidence of its utility by presenting data collected from this tool in an ongoing TBI study.

Methods

BISQ-IPV module development

To generate content for the item cues, we examined the TBI screening tools cited in Goldin and colleagues[35] and others,[9,40] and we also examined broader IPV screening tools that are validated for the detection of physical, sexual, or psychological IPV in general practice settings but were not explicitly designed to detect brain injury[54–58] as well as other single-item screeners.[51] We reviewed a single-item query modeled after the American Congress of Rehabilitation Medicine Brain Injury Interdisciplinary Special Interest Group (ACRM BI-ISIG) definition of mild TBI,[23] ''After anything that your partner has ever done to you, have you ever lost consciousness or blacked out?'' after which positive responses are followed with subsequent semi-structured questions to better characterize the incident and its severity. We also reviewed a modified Veterans Administration TBI screening tool designed to detect IPV-related TBI.[59,60]

We compiled all items that pertain to events that could lead to brain injury; all items pertaining exclusively to sexual, verbal, and psychological abuse were removed. Two authors (KDOC and LS) presented items relating to physical abuse to the research team at the Brain Injury Research Center to seek consensus regarding whether the behaviors could plausibly result in injury to the brain; items deemed very unlikely to cause injury to the brain (e.g., twisting arm) or that were too nonspecific with respect to body parts involved (e.g., incurring a sprain due to a fight with partner) were discarded. Items that could possibly result in injury to the brain (e.g., being hit on the head by partner) were retained. We grouped items according to similarity (e.g., all items referring to pushing, shoving, smashing the head; all items pertaining to hitting the head with an object or hand, etc.) and removed items that were redundant, overlapping, or that could be easily collapsed into a single more broadly-worded item. For example, separate queries regarding facial/orbital fracture and injury to the ears were combined into one. Manual, ligature, and other strangulation-related queries were abandoned in favor of one broader item referring to strangulation. Pushing down stairs was deemed to be adequately covered in a broader ''pushed/shoved'' item. Items pertaining to hits to the head with different objects were discarded in favor of a broader item that refers to being hit on the head with ''an object, hand, or fist.'' Seven cues were retained and formatted using the same structure that is used in the BISQ,[39] wherein each item serves as a recall cue and positive responses are further queried to ascertain presence and duration of altered mental status and/or unconsciousness.

Iterative revision process

We sought feedback and revised the draft BISQ-IPV module based on suggestions from IPV experts and stakeholders. Members of the authorship team were present for each round of iterative revision; as such, all decisions regarding additions, deletions, and modifications were made in partnership with stakeholders.

IPV-BI Educational Workshop. Approximately 50 stakeholders attended an in-person educational workshop in North Bay Canada to provide basic TBI information to various support professionals who offer services to survivors of IPV and to share an educational toolkit developed by the facilitators for use in this context.[61] Participants included women survivors, frontline workers in IPV direct service settings, administrators, healthcare providers, police, and legal professionals. Meeting organizers provided a brief overview of the risks and benefits of screening for IPV and brain injury, and invited participants to opine on the development of a screening tool. Paper copies of the BISQ-IPV module were then shared with participants, and organizers asked them to provide feedback on the language, content, structure, feasibility, and safety of administration of the draft screening tool. Participants were further invited to indicate what they liked about the measure and what they would change. Workshop participants were seated at round tables, and some chose to work in small groups while others worked individually to review the BISQ-IPV module and suggest changes, corrections, and other modifications by writing directly on the paper tool and/or on separate sheets of blank paper provided. Following individual review and small group discussions, a large group discussion provided additional opportunity for stakeholders to provide oral feedback that was summarized by a notetaker.

Sexual Assault and Violence Intervention Program. A second round of stakeholder feedback came from staff and volunteer advocates, including IPV survivor advocates, at the Mount Sinai Sexual Assault and Violence Intervention (SAVI) Program. Founded in 1984, the Mount Sinai SAVI Program supports survivors of IPV and sexual assault through emergency department advocacy, crisis intervention, free and confidential trauma-informed therapy services, and public education and prevention programs. SAVI leadership presented the revised draft BISQ-IPV module (which integrated feedback from the North Bay meeting) to all staff via email, along with a brief description of the BISQ and our goals for refining the BISQ-IPV module. Stakeholders were invited to review the BISQ-IPV module and be prepared to provide feedback with respect to refining language and optimizing content coverage, feasibility, and safety of administration.[18] Members of the research team joined a SAVI staff teleconference held approximately 2 weeks later, during which time the BISQ-IPV module was reviewed in real time and a member of the research team recorded all feedback on an electronic

version of the module so teleconference attendees could verify that their feedback was accurately reflected. SAVI team members who were unable to attend the teleconference were invited to provide feedback by making comments and suggested edits on an electronic version of the BISQ-IPV module and emailing it to the research team.

BISQ-IPV module implementation

We introduced the refined BISQ-IPV module into the Late Effects of TBI (LETBI) study. The LETBI study is a longitudinal prospective brain donor program that invites individuals who have sustained at least one moderate-severe TBI, two or more mild TBIs, or substantial exposure to RHI at least 1 year prior to study enrollment to participate in multi-modal clinical characterization during life and make known their wishes for brain donation.[62] Participants were recruited from the TBI Model Systems of care at Mount Sinai and University of Washington, and from the greater New York tri-state area by sharing flyers and study information on social media and in community-based settings known to serve individuals with TBI.[62] The core BISQ, which asks about injuries in the context of abuse and assault but does not specifically query IPV, has been part of the LETBI study battery since 2015. The BISQ-IPV module was added in 2018. All research activities were approved by the program for the protection of human subjects.

Preliminary characterization of BISQ-IPV module utility

We used descriptive statistics (frequencies and percentages) to describe the demographic characteristics (sex, age, race, socioeconomic status) of the individuals who completed the core BISQ and who completed the core BISQ preceded by the BISQ-IPV module. Then, we characterized violent and IPV-related injury reporting among those who completed the core BISQ only and those who completed the BISQ-IPV module in addition to the BISQ. In the subset who completed the BISQ-IPV module, we compared demographic characteristics among those who reported no history of IPV-related head or neck injury, those who reported IPV-related head/neck injury but no BI, and those who reported IPV-related BI. We examined other reported lifetime head trauma exposures in those with a history of IPV-BI, and we characterized the temporal relationships of injuries in the subsample of individuals who completed the core BISQ followed by BISQ-IPV module 3 years later.

Results

BISQ-IPV module refinement

IPV-BI Educational Workshop. Feedback from workshop stakeholders suggested that we specify ''strangled OR choked'' for the item pertaining to nonfatal strangulation (previously represented as ''strangled''), as stakeholders reported that the word ''choke'' is more commonly used by survivors. Based on feedback provided, we discussed inclusion of additional cues, such as being thrown down the stairs and behaviors that could result in suffocation (e.g., smothering with a pillow, holding head under water), but we did not include these cues to avoid redundancy and maximize brevity. We did, however reword one item to read ''Strangled or suffocated (''choked'') you'' in an effort to encompass behaviors that could interrupt airflow.

Feasibility of administering the screening tool in busy and sometimes under-staffed clinical and community-based settings was also commented on in written feedback; this advice dissuaded us from adding items. In addition to minor modifications to ensure recall cues used inclusive language to query specific contexts, we retained a final broad cue intended to capture IPV-related injuries not otherwise queried. Although it was outside the scope of the feedback requested, stakeholders also recommended edits to the demographics questions that are not part of the IPV-module but that were printed on the back of the paper form. In response to this feedback, we added language to distinguish sex at birth from gender identity. We declined to add additional questions about disability identity or functional status, as the team agreed these constructs fell outside the scope of a demographics form and should be carefully selected based on intended clinical and/or research use.

SAVI. SAVI stakeholders were presented with the revised BISQ-IPV module, and feedback consisted primarily of guidance regarding interpretation of screening results and recommendations for how to use the tool safely, with very few recommendations (as described below) for changes to the language of the measure itself. Multiple stakeholders suggested adding referral resources to the IPV-BI screening page; we took this suggestion and included contact information for one national and one local resource. Other SAVI team members also stressed the importance of providing the questionnaire in multiple languages. With respect to the terminology used in the screening items, it was recommended that we change revised item 5 from ''… strangled or choked'' to ''… strangled (choked) you.'' This feedback was supported by multiple others who agreed that IPV survivors most commonly use the word ''choked'' to describe the range of behaviors that cause what is referred in the professional literature as ''strangulation,'' i.e., manual or ligature strangulation and related behaviors that compromise breathing. There was a sense that including ''choked'' as a parenthetical statement would serve also to indicate that what a survivor may call ''choking'' may be referred to by professionals as

nonfatal strangulation. Identifying and using the nomenclature preferred by survivors has been recommended throughout the IPV literature.[16,33,63]

One stakeholder wondered whether the language of the final cue (''…caused other injury to your head, neck, or face'') was not broad enough. The concern was that the item may not elicit report of injuries to other parts of the body or behaviors that threaten violence such as verbal abuse, throwing objects in a room or punching a wall, and other manipulative and controlling behaviors. We did not elect to alter this item based on the rationale provided, as the goal of the BISQ-IPV module was to screen for injuries that may result in brain injury. Other than what is described here, no further feedback was provided but not incorporated.

The final BISQ-IPV module includes six items pertaining to specific behaviors/contexts in which an IPV-BI may occur, and one broader item to query ''any other injuries to the head, neck, or face,'' for a total of seven items that serve as recall cues specific to IPV-BI including NFS (see Supplementary Table S1). Acknowledging that some respondents have sustained more injuries than can reasonably be quantified, the authorship team opted to include a final query to record the number and duration of relationships in which a partner was physically violent. In the LETBI study assessments, the BISQ-IPV module was followed by the core 20-item BISQ. Respondents are instructed not to report injuries on the core BISQ that they have already reported in the preceding modules; this clear instruction is intended to avoid reporting the same injury more than once.

Table 1. Demographic and Injury Characteristics Among Those Who Completed the Core BISQ ($n = 156$) and the Core BISQ + IPV Module ($n = 142$)

	Completed Core BISQ[a] n = *156*	*Completed core BISQ+IPV Module*[b] n = *142*
Sex at birth *n* (% female)	N/A	53 (37.3%)
Gender identity *n* (% female)	58 (37.2%)	50 (35.2%)
Age [mean (SD)]	57.9 (12.6)_	53.1 (14.4)
Education [mean (SD)]	15.8 (2.87)	15.6 (3.08)
Education[a]		
Less than high school	5 (3.21%)	6 (4.23%)
High school	19 (12.2%)	21 (14.8%)
Some college	21 (13.5%)	21 (14.8%)
College and beyond	108 (69.2%)	93 (65.5%)
Race		
White	134 (85.9%)	119 (83.8%)
Black/African American	10 (6.41%)	5 (3.52%)
Other	12 (7.69%)	13 (9.15%)
Ethnicity		
Hispanic/Latino	16 (10.3%)	16 (11.3%)
Annual household income		
Less than or equal to $20,000	33 (21.2%)	34 (23.9%)
$20,001-$40,000	22 (14.1%)	15 (10.6%)
$40,001-$60,000	13 (8.33%)	15 (10.6%)
$60,001-$100,000	31 (19.9%)	28 (19.7%)
More than $100,000	38 (24.4%)	40 (28.2%)
Don't know	15 (9.62%)	10 (14.2%)

[a]Three individuals did not report education, and four individuals did not report income.

[b]Three individuals did not report sex at birth, one individual did not report education, five individuals did not report race, and seven did not report ethnicity.

BISQ, Brain Injury Screening Questionnaire; IPV, intimate partner violence; SD, standard deviation.

Preliminary utility of BISQ-IPV module

Rates of IPV and violent head trauma. There were 156 individuals who completed the Core BISQ as part of the LETBI study between 2015 and 2018 before the BISQ-IPV module was added, and 142 who completed the BISQ-IPV module and the Core BISQ between 2018 and 2021 after the addition of the BISQ-IPV module. These 298 total visits represent 233 unique individuals: 65 individuals completed one visit before the addition of the BISQ-IPV module and had a follow up visit after the module's inclusion. Thirty-nine percent of all participants (90/233) identified as female, 82% (192/233) were white, mean (standard deviation) age was 53.4 (14.2) and they reported 16.8 (2.47) years of education. Those who did and did not complete the BISQ-IPV Module did not differ in gender, age, education, race, ethnicity, or income (data not shown); demographics of the samples who did and did not complete the BISQ-IPV module are presented in Table 1.

TBI is defined as an injury to the head, face, or neck that interrupted normal brain function as demonstrated by an alteration of mental status and/or loss of consciousness as per the ACRM BI-ISIG,[64] Brain Injury Association of America,[65] Centers for Disease Control and Prevention,[66] Department of Defense criteria.[67] By extension, if these criteria were met following NFS, we considered this a brain injury (NFS-BI). The developers of the core BISQ[68] used the words ''dazed and confused'' to operationalize alteration of mental status; this operational definition was similarly used herein. We defined non-TBI ''head injury'' as a blow to the head, face, or neck that did not result in any alteration in mental status (i.e., that did not meet clinical criteria for a TBI). We similarly considered NFS that did not result in altered mental status a ''NFS event.'' Finally, when we refer to head injuries/TBIs reported in response to the two items on the core BISQ that query violent contexts (e.g., assault/mugging, or physical abuse) wherein it was not specified whether the injury was related to IPV, we use the broader term ''Violent Head Injury'' or ''Violent TBI.'' As described above, IPV-BI is an encompassing term that refers to either IPV related TBI or NFS resulting in BI.

In Table 2, we present the number and percentage of individuals who reported IPV-specific events and BI including NFS, which was not queried on the core BISQ. Of the sample who completed the BISQ-IPV module, 22 individuals (15% of the total, including 34% of the

Table 2. Self-Reported Head and Neck Trauma Exposure on the Core BISQ and Core BISQ + BISQ-IPV Module Among Participants in the LETBI Study

		Core BISQ N = *156*[a]			*Core BISQ + BISQ-IPV Module* N = *142*[a]		
		Male n = *98*	*Female* n = *58*	*All* N = *156*	*Male* *n* = *92*	*Female* *n* = *50*	*All* N = *142*
IPV-specific head/neck injuries (IPV module)							
IPV head/Neck injury events[d]	*n* (%) individuals with IPV-head injury	(N/A)	(N/A)	(N/A)	5 (5%)	15 (30%)	20 (14%)
	n (%) individuals with NFS events	(N/A)	(N/A)	(N/A)	0 (0%)	3 (6%)	3 (2%)
	***n* (%) unique individuals reporting any IPV- related head injuries or NFS events**	**(N/A)**	**(N/A)**	**(N/A)**	**5 (5%)**	**17 (34%)**	**22 (15%)**
	Total cumulative number of IPV-related injuries[b]	(N/A)	(N/A)	(N/A)	7	89	96
IPV- Brain injury[e]	*n* (%) individuals reporting IPV-TBIs	(N/A)	(N/A)	(N/A)	0	10 (20%)	10 (7%)
	n (%) individuals reporting NFS-BI	(N/A)	(N/A)	(N/A)	0	1 (2%)	1 (1%)
	n (%) unique individuals reporting any IPV-BI	**(N/A)**	**(N/A)**	**(N/A)**	**0**	**11 (22%)**[c]	**11 (8%)**
	Total cumulative number of IPV-BIs reported[b]	(N/A)	(N/A)	(N/A)	0	16	16
Violent head/neck injuries (Core BISQ)							
Violent head/neck injury events[d]	*n* (%) individuals with blow to the head in assault/mugging	9 (9%)	2 (3%)	11 (7%)	8 (9%)	0 (0%)	8 (6%)
	n (%) individuals with blow to the head from physical abuse	7 (7%)	5 (7%)	12 (8%)	3 (3%)	1 (2%)	4 (3%)
	***n* (%) unique individuals reporting blows to the head from either assault/mugging or physical abuse**	**14 (14%)**	**6 (10%)**	**20 (13%)**	**8 (9%)**	**1 (2%)**	**9 (6%)**
	Total cumulative number of violent injuries[b]	24	22	46	17	2	19
Violent TBI[e]	*n* (%) individuals reporting TBI in assault/mugging	11 (11%)	3 (5%)	14 (9%)	19 (21%)	6 (12%)	25 (18%)
	n (%) individuals reporting TBI from physical abuse	0 (0%)	0 (0%)	0 (0%)	2 (2%)	3 (6%)	5 (4%)
	***n* (%) unique individuals reporting TBI from assault/mugging or physical abuse**	**11 (11%)**	**3 (5%)**	**14 (9%)**	**21 (15%)**	**6 (12%)**	**27 (19%)**
	Total cumulative number of violent TBIs[b]	16	4	20	22	9	31
Total number (%) individuals reporting violent or IPV-related injuries or BIs							
Total number of individuals reporting IPV-related head injury, NFS event, or IPV-BI (including NFS-BI)		(N/A)	(N/A)	(N/A)	5 (5%)	17 (34%)	22 (15%)
Total number of individuals reporting violent head injury or violent TBI		21 (21%)	8 (14%)	29 (19%)	27 (28%)	6 (12%)	33 (23%)

Bolded text distinguishes data on n (%) UNIQUE individuals reporting each exposure.

[a]There are 65 individuals represented in both samples; these individuals completed one study visit before the BISQ-IPV module inclusion and one study visit after.

[b]The cumulative number of injuries exceeds the number of individuals reporting each injury/BI, as some individuals reported >1 injury/BI.

[c]All individuals who reported an IPV-BI also endorsed IPV and/or NFS events that did not result LOC or AMS.

[d]Injury to head or neck not resulting in loss or alteration of consciousness.

[e]Injury to head or neck resulting in loss or alteration of consciousness.

AMS, altered mental status; BISQ, Brain Injury Screening Questionnaire; IPV, intimate partner violence; LOC, loss of consciousness; NFS, nonfatal strangulation; TBI, traumatic brain injury; BI, brain injury.

women) reported a history of at least one IPV- or NFS-related event, not including TBIs/BIs; 11 of the sample (8% of the total), all of whom were women, reported at least one event that met criteria for an IPV-TBI or NFS-BI. No men reported a NFS event, but three women (6%) did. The core BISQ does not include any IPV-specific queries and does not query NFS; as such none were recorded. We used italics in Table 2 to illustrate the total cumulative number of injuries reported for each etiology. On the BISQ-IPV module, women who reported any IPV-related injuries reported, on average, six injuries (range 1-22). Women who endorsed IPV-related TBI ($n = 11$) reported an average of 1.5 TBIs per person (range 1-5 TBIs).

In Table 2, we also report rates of violent head injury and violent TBI, which are queried on the core BISQ in two items pertaining to assault/mugging or abuse without specifying the context (i.e., IPV, hate crime, child abuse, geriatric abuse, etc.). In the group that completed the BISQ-IPV module ($n = 142$), the BISQ-IPV module precedes the core BISQ and respondents are reminded not to report the same injury more than once. Those who completed only the core BISQ reported higher rates of violent head injury (14% of men and 10% of women) than those who completed the BISQ-IPV module (9% of men and 2% of women), suggesting that IPV-specific injuries were already accounted for on the BISQ-IPV module. However, the cumulative number of IPV- and violent non-IPV injury events reported by those who completed the BISQ-IPV module (115 injuries: 96 IPV-related injury events and 19 violent injuries) was more than twice that of those who completed only the core BISQ (46 violent injuries). Further, the rate of violent TBIs reported in response to these core BISQ items was twice as high in the group who completed both the BISQ-IPV module + core BISQ compared with those who completed the core BISQ alone (19% and 9%, respectively).

Demographic and injury characteristics among those with and without IPV exposure. In the sample of participants who completed the BISQ-IPV module ($n = 142$), we examined demographic and injury characteristics by IPV-BI exposure status (Table 3). There were 11 individuals (five men and six women) who endorsed IPV-related head injuries or NFS events on the BISQ-IPV Module that did not meet the threshold of BI. There were an additional 11 individuals (0 men, 11 women) who endorsed IPV-BI (i.e., IPV-TBI or NFS-BI); findings reported herein should be interpreted with caution given this small sample size (total $n = 22$ with IPV-related injuries or events). Those who reported IPV-related head injury were, on average, more than a decade younger than those who reported no IPV exposure or IPV-BI. Women were a minority in the group with no IPV exposure, while 100% of those with IPV-BI were women. The group with no IPV exposure had the greatest proportion of White and smallest proportion of Black individuals. Those reporting IPV-related head injury had slightly less education than the other two groups, and the majority (82%) of those reporting an IPV-BI had a college education. Among those reporting IPV-related head injury or IPV-BI, the most commonly reported annual household earnings was $20,000 or less per year (46% and 64%, respectively), compared with those without IPV exposure. Those with IPV-related head injury or IPV-BI reported approximately double the number of non-IPV head injuries and also reported a greater number of lifetime TBIs than those who reported no IPV-related injuries. Those with IPV-head injury and IPV-BI exposure reported greater lifetime head trauma exposure than those without any IPV-related head injury, and those with IPV-BI had the most moderate-severe TBIs.

Lifetime TBI exposure among those with IPV-BI. Finally, we examined lifetime head trauma exposure reported among the 11 women who reported IPV-BI on the BISQ-IPV Module (Supplementary Table S2). The majority of IPV-BI occurred secondary to pushing/shoving the head into an object (46%) and/or hitting the head with an object/hand (46%). TBI of other etiologies was common among those with IPV-BI; six women (55%) also reported TBI of non-violent etiologies such as falls (1(9%)) and motor vehicle accidents (27%). Approximately half of those with IPV-related injuries also endorsed abuse or assault on the core BISQ. Given the clear guidance to not report the injuries previously reported on the BISQ-IPV module, these can be interpreted as additional injuries which suggests that non-IPV violent injury was common in those exposed to IPV-related head trauma.

Table 3. Demographic Characteristics of Those Who Completed Core BISQ+BISQ-IPV Module by Head Injury and Brain Injury History

	No IPV head injury or BI n = *120*	*IPV head injury or NFS event (no BI)* n = *11*	*IPV-BI* n = *11*
Sex at birth *n* (% female)	36 (30%)	6 (54.5%)	11 (100%)
Gender identity *n* (% female)	33 (27.5%)	6 (54.5%)	11 (100%)
Age mean (SD)	53.6 (14.7)	42.3 (12.1)	55.3 (7.60)
Race			
White	104 (86.7%)	7 (63.6%)	8 (72.7%)
Black/African American	3 (2.5%)	1 (9.09%)	1 (9.09%)
Other	9 (7.5%)	2 (18.2%)	2 (18.2%)
Ethnicity			
Hispanic/Latino	13 (10.8%)	2 (18.2%)	1 (9.09%)
Education mean (SD)	15.6 (2.94)	14.4 (4.44)	16.1 (3.54)
Education[a]			
Less than high school	4 (3.33%)	1 (9.09%)	1 (9.09%)
high school	18 (15%)	3 (27.3%)	0 (0%)
Some college	19 (15.8%)	1 (9.09%)	1 (9.09%)
College and beyond	79 (65.8%)	5 (45.5%)	9 (81.8%)
Annual household income			
Less than or equal to $20,000	22 (18.3%)	5 (45.5%)	7 (63.6%)
$20,001-$40,000	14 (11.7%)	1 (9.09%)	0 (0%)
$40,001-$60,000	15 (12.5%)	0 (0%)	0 (0%)
$60,001-$100,000	26 (21.7%)	1 (9.09%)	1 (9.09%)
More than $100,000	35 (29.2%)	2 (18.2%)	3 (27.3%)
Don't know	8 (6.67%)	2 (18.2%)	0 (0%)
Military service history *n* (%)	16 (13.3%)	2 (18.2%)	0 (0%)
Contact sports participation *n* (%)	56 (46.7%)	4 (36.4%)	3 (27.3%)
Number of lifetime head injuries mean (SD)	5.71 (6.27)	10.3 (10.7)	14.8 (14.1)
Number of TBIs mean (SD)	2.18 (1.71)	3.09 (2.34)	3.82 (2.27)
Most severe TBI			
Repetitive mild/	39 (32.5%)	5 (45.5%)	2 (18.2%)
complicated mild	13 (10.8%)	1 (9.09%)	2 (18.2%)
Moderate	68 (56.7%)	5 (45.5%)	7 (63.6%)
Severe			

BISQ, Brain Injury Screening Questionnaire; IPV, intimate partner violence; BI, brain injury; SD, standard deviation; TBI, traumatic brain injury.

Temporality of IPV and non-IPV violent injuries. We examined the 65 individuals who completed the core BISQ at one LETBI study visit and then completed the core BISQ+BISQ-IPV module at a subsequent visit approximately 3 years later. Data on dates of injury indicated that the violent injuries that were reported following the BISQ-IPV had occurred prior to the previous core BISQ administration, but were not reported at that time, suggesting that the IPV-specific cueing may have elicited greater recall of remote violent injuries.

Among the 11 women reporting IPV-BI, we explored the temporal associations of IPV-TBI/NFS-BI and non-IPV TBI. Four individuals sustained an IPV-BI before sustaining a non-IPV TBI(s), two sustained an IPV-BI after a non-IPV TBI, and three individuals sustained an IPV-BI in between other non-IPV-related TBIs. Information was missing on date(s) for at least one injury reported by the remaining two women, precluding characterization of temporal relationships.

Discussion

Following two rounds of iterative revision, the BISQ-IPV module is fully compliant with expert consensus criteria for IPV-specific brain injury screening,[69] and can be used alongside the core BISQ to enhance detection and achieve the comprehensive characterization of IPV-BI exposure history.[43] The final BISQ-IPV module items overlap well with other recently developed screening tools for use in military populations,[40,60,70] which will facilitate comparisons across cohorts and settings. Preliminary utility data suggest that, consistent with prior literature, specific cueing about IPV-related injuries appears to elicit more comprehensive reporting as compared with more general queries about violence or safety.[46,51,71,72] Current results suggest that IPV-specific cues may also enhance recall of other violent TBIs sustained across the lifespan (e.g., physical abuse at the hands of someone other than an intimate partner, or injuries resulting from being assaulted or mugged). In the current sample of individuals with TBI, IPV sometimes preceded and sometimes followed TBI of other etiologies; these findings are consistent with literature suggesting individuals with disability are at elevated risk for partner violence[16,63] and that prior exposure to TBI increases risk for subsequent (including accidental) injuries across the lifespan.[73–75]

The current findings have implications for research and clinical care. The data presented herein were collected from a community-dwelling sample of individuals with TBI; no targeted recruitment in settings specific to IPV, psychological, or sexual trauma survivors was conducted. As such, these data reflect rates of IPV-BI and IPV-head trauma that is not recognized as such in TBI studies that do not explicitly query IPV-related injuries. To the extent that TBI survivors with a history of IPV may have unique outcomes and risk factors for long-term decline, IPV may be an important hidden variable in TBI research.

Screening for IPV in clinical settings, particularly those offering services to survivors of violence, was recommended by the United States Preventive Services Task Force (USPSTF) in 2018.[76] The benefits of screening for IPV-BI in particular have not been thoroughly investigated, but screening may offer important opportunities for prevention. Some evidence suggests that care-seeking (which is often delayed until violence and injury severity escalates over time)[77–79] may be a harbinger of IPV-related homicide.[80] Further, it can be helpful to identify potentially modifiable brain injury-related impairments that directly impact a survivor's ability to benefit from resources available, reduce misattribution of symptoms, and facilitate access to relevant services. While the mental health consequences of IPV (e.g., depression, anxiety, substance use, and post-traumatic stress disorder) have been extensively studied, physical and neurological sequelae of IPV-BI have until recently been largely ignored.[25,81] The multiple distinct injury patterns (TBI, RHI, NFS) seen in IPV-BI can have cumulative and potentially interactive effects on cognitive and neurobehavioral impairment, overall health and function, and dementia risk. Many survivors of moderate-severe TBI, and some with mild TBI (mTBI) or RHI, experience enduring cognitive impairment,[82–84] cognitive decline,[83,85] and neurobehavioral symptoms such as aggression, irritability, and disinhibition,[86,87] which can progress over time.[88] Motor symptoms, such as gait impairment, imbalance, tremor, and other parkinsonian signs,[89–94] further contribute to impairment in moderate-severe TBI,[94,95] and may decline even after mild TBI[96,97] or RHI.[98–100] These injury sequelae, both individually and collectively, can place IPV survivors at greater risk for additional IPV and non-IPV related head injuries.

Additional work towards the validation of the BISQ-IPV module is needed despite the inherent challenges of validating a tool for which no external gold-standard criterion exits. Community-based participatory research that tailors screening tools to their intended setting is necessary to inform best practices; for example, the BISQ-IPV module may be appropriate for busy IPV service settings, while a longer form may be required for use with individuals who have a known history of IPV-BI and/or other lifetime exposure to TBI. It is not yet known whether the seven brief cues in the BISQ-IPV are adequate for eliciting full report of IPV-related head trauma; future research may inform the need for modification or addition of cues. Further research is needed in IPV survivor samples to examine the cumulative impact of IPV-related RHI with or without IPV-BI given the association of these injury patterns with biological[101] and behavioral[102] outcomes. Research on the

neuropathology of RHI sustained in contact sports suggests that years of contact sport participation has a linear relationship with extent of pathology[103–106]; indices of duration of violent relationships may warrant exploration as a proxy and/or supplement to self-report.

Finally, best practices to maximize acceptability and safety of IPV-BI screening are not fully understood, and optimal modes of administration requires further evaluation. Some evidence suggests that survivors may be more likely to disclose IPV to an advocate, social worker, or certified nurse-midwife, and rates of IPV reporting differ across physician specialties.[47,52,107–109] Computer-administered screening methods may be preferable to patients and providers alike, as they provide privacy and can improve feasibility of large-scale screening efforts; a review suggests that computerized self-report screening methods yielded higher rates of IPV disclosure compared with written or face-to-face screening methods.[107] The BISQ can be deployed in any of these modalities, but preferred modality may depend on the population, setting, and feasibility of screening. Per WHO recommendations, it is critical that detailed administration guidelines accompany any IPV or IPV-BI screening initiative to safeguard survivors and their loved ones.[110–112] Further, there is a specific need to examine acceptability of item stems in diverse samples; the ways in which violent behaviors are expressed and the language used to describe violent behaviors may differ across countries, cultures, racial and ethnic groups,[113,114] older adults,[115] and gender diverse populations.[116]

There are limitations of the current study, and of the IPV-BI screening tool described herein, that warrant consideration. The BISQ uses broad language to operationalize alteration of consciousness and distinguish a blow to the head from a TBI, and instruments that use different language or invoke additional concepts such as duration of retrograde or anterograde amnesia may yield different self-report. The BISQ and BISQ-IPV module is intended to screen for brain injury, and is not appropriate to screen for IPV in general, which includes physical, verbal, and sexual violence. Well-validated measures for IPV screening exist, and may be used alongside the BISQ to identify and characterize IPV history. The BISQ may be most appropriate to use in clinical or research settings wherein the primary goal is to efficiently achieve comprehensive screening of lifetime head trauma exposure (i.e., contact sports, military service, IPV, and isolated TBI of multiple etiologies). Examples include TBI research studies, and front-line settings serving those with known IPV exposure (e.g., community-based supports and shelters, or healthcare settings) where information about head trauma will inform service delivery, clinical care, and resource facilitation. More comprehensive open-ended interviews may be preferable in some clinical and research settings; more research is needed to determine relative strengths of distinct IPV-BI screening methods across settings. Further research will be needed to explore whether indices such as duration of violent relationships are informative in clinical or research settings.

The use of a convenience control sample is a limitation of the current study that precludes comprehensive investigation into the frequency with which TBI survivors endorse IPV-related TBI in response to more general cues regarding abuse or assault. Finally, the BISQ-IPV module data collection in the LETBI study overlapped with the COVID-19 pandemic, during which time increases in rates of IPV were reported worldwide.[117] None of the IPV-BIs reported on BISQ were sustained in 2020-2021 (i.e., observed reporting is not attributable to pandemic-related increases in violence).

Conclusion

Brain injury resulting from IPV is a hidden epidemic, with IPV-related injuries remaining occult to identification even in clinical care and research settings where gold standard TBI ascertainment tools are used. Inclusion of specific IPV-related recall cues may be necessary for more comprehensive injury ascertainment. TBI is both a consequence of, and a risk factor for, IPV victimization,[118,119] especially in women.[120–122] IPV-BI screening, particularly in high-risk groups such as those living with TBI, is essential for advancing scientific understanding its medical and neurological consequences. Accurate accounting of the population prevalence of IPV-BI is foundational to advocacy efforts to ensure IPV survivors have access to the individualized care and resources they need.

Transparency, Rigor, and Reproducibility Summary

The study design for the parent Late Effects of TBI (LETBI) study was pre-registered in a methods paper published in the Journal of Neurotrauma in 2018 (doi: 10.1089/neu.2017.5457). The current manuscript reports on a secondary analysis of data available from the LETBI study, as such no analysis plan was proposed in the funded grant(s), and no analysis plan was registered prior to data collection. The lead author, Kristen Dams-O'Connor, certifies that the analysis plan for the current manuscript was pre-specified unless otherwise specified (i.e., described as an exploratory analysis initiated in response to results of pre-specified analyses). Planned sample size for the LETBI study differs across funding sources and sub-projects with varying requirements for statistical power. Statistical power was not calculated for the current study, which is descriptive in nature; no statistical comparisons are made.

Data collection and analysis was performed by study team members who were blinded to relevant participant characteristics (e.g., history of partner violence, responses to previously administered lifetime head trauma screening questionnaires when applicable). Data were

collected during usual work hours between 2015 and 2021. Demographic and injury histories were collected using self-report questionnaires and clinician interview. Data were analyzed using SAS. No unexpected events occurred in the course of the current study. The interpretation of measurements is contingent on an understanding of the timelines in which the data were acquired; in the case of the current analysis, data collected using a standard head trauma screening tool were compared with data collected using a more detailed version of this tool that had not yet been developed at the start of the parent study. As such, responses to the more detailed screening tool are compared with responses on the standard tool across cohorts and across individuals (in the subsample of participants who completed a study visit that did and did not include the more detailed questionnaire items). Quantitative test–retest reproducibility using the same participants assessed repeatedly is inconsistent with the purpose of this secondary analysis, which is explicitly intended to examine differences in response across a standard and expanded version of a measure. All software used for data collection and data analysis are widely available. The key inclusion criteria for the parent LETBI study are based on established standards in the field. The primary clinical outcome (i.e., self-report of lifetime history of head trauma exposure) is an emerging standard in the field, wherein the current contribution intends to improve upon existing tools which have been deemed inadequate by expert panels. Replication and external validation of the findings reported herein is encouraged, and is facilitated by data sharing. Data underlying the presented analyses are available in Federal Interagency Traumatic Brain Injury Research (https://fitbir.nih.gov). Analytic code used to conduct the analyses presented in this study are available by emailing the corresponding author.

Authors' Contributions

KDOC: conceptualization, funding acquisition, writing (original draft, review and editing). AB: data curation (lead), analysis (lead); writing—review and editing (supporting). HH: investigation (supporting); writing—original draft (supporting); writing—review and editing (supporting). LS: data curation (supporting), analysis (supporting); writing—review and editing (supporting). AF: investigation (supporting); writing—original draft (supporting); writing—review and editing (supporting). LFH: investigation (supporting); writing—original draft (supporting); writing—review and editing (supporting). JMH: writing—review and editing (supporting). YGF: writing—review and editing (supporting).

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Author Disclosure Statement

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Supplementary Material

Supplementary Table S1
Supplementary Table S2

References

1. Catalano S. Special Report: Intimate Partner Violence, 1993-2010. U.S. Department of Justice: Washington D.C.; 2012.
2. NCADV. Statistics Denver, Colorado. 2022. Available from: https://ncadv.org/STATISTICS [Last accessed: November 9, 2022].
3. Archer J. Sex differences in aggression between heterosexual partners: a meta-analytic review. Psychol Bull 2000;126(5):651–80; doi: 10.1037/0033-2909.126.5.651
4. Arias I, Corso P. Average cost per person victimized by an intimate partner of the opposite gender: a comparison of men and women. Violence Vict 2005;20(4):379–391.
5. O'Leary K. Gender symmetry or asymmetry in intimate partner victimization? Not an either/or answer. Partner Abuse 2010;1(2):17.
6. Tjaden P, Thoennes N. The role of stalking in domestic violence crime reports generated by the Colorado Springs Police Department. Violence Vict 2000;15(4):427–441.
7. Campbell JC, Lewandowski LA. Mental and physical health effects of intimate partner violence on women and children. Psychiatr Clin North Am 1997;20(2):353–374; doi: 10.1016/s0193-953x(05)70317-8
8. Violence. NCAD. Domestic violence national statistics. 2015. Available from: https://www.ncadv.org [Last accessed: November 30, 2022].
9. Valera EM, Berenbaum H. Brain injury in battered women. J Consult Clin Psychol 2003;71(4):797–804; doi: 10.1037/0022-006x.71.4.797
10. Monahan K, Goldfine A, Biegon A. Traumatic brain injuries in victims of intimate partner violence: an underappreciated source of neurological morbidity. Future Neurol 2017;12(4):189–191; doi: 10.2217/fnl-2017-0026
11. Monahan K. Intimate partner violence (IPV) and neurological outcomes: a review for practitioners. J Aggress Maltreat Trauma 2019;28(7):807–825; https://doi.org/10.1080/10926771.2019.1628154
12. Banks ME. Overlooked but critical: traumatic brain injury as a consequence of interpersonal violence. Trauma Violence Abuse 2007;8(3):290–298; doi: 10.1177/1524838007303503
13. Zieman G, Bridwell A, Cárdenas JF. Traumatic brain injury in domestic violence victims: a retrospective study at the Barrow Neurological Institute. J Neurotrauma 2017;34(4):876–880; doi: 10.1089/neu.2016.4579
14. Black MC, Basile KC, Breiding MJ, et al. The National Intimate Partner and Sexual Violence Survey (NISVS): 2010 Summary Report. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention: Atlanta, GA; 2011.
15. St Ivany A, Schminkey D. Intimate partner violence and traumatic brain injury: state of the science and next steps. Fam Community Health 2016;39(2):129–137; doi: 10.1097/FCH.0000000000000094
16. Haag HL, Jones D, Joseph T, et al. Battered and brain injured: traumatic brain injury among women survivors of intimate partner violence—a scoping review. Trauma Violence Abuse 2022;23(4):1270–1287; doi: 10.1177/1524838019850623
17. Campbell JC, Anderson JC, McFadgion A, et al. The effects of intimate partner violence and probable traumatic brain injury on central nervous system symptoms. J Womens Health (Larchmt) 2018;27(6):761–767; doi: 10.1089/jwh.2016.6311
18. Monahan K, Bannon S, Dams-O'Connor K. Nonfatal strangulation (NFS) and intimate partner violence: a brief overview. J Fam Violence 2022;37(1):75–86.
19. Valera E, Kucyi A. Brain injury in women experiencing intimate partner-violence: neural mechanistic evidence of an "invisible" trauma. Brain Imaging Behav 2017;11(6):1664–1677; doi: 10.1007/s11682-016-9643-1

20. Monahan K, O'Leary KD. Head injury and battered women: an initial inquiry. Health Soc Work 1999;24(4):269–278; doi: 10.1093/hsw/24.4.269
21. Harway M, Hansen M. Spouse Sbuse: Assessing and Treating Battered Women, Batterers, and their Children, 2nd ed. Professional Resource Press/Professional Resource Exchange: Sarasota, FL; 2004; pp. viii, 99.
22. Koss MP GL, Browne A, Fitzgerald LF, et al. Physical and psychological outcomes of partner violence. In: No Safe Haven: Male Violence against Women at Home, at Work, and in the Community. American Psychological Association: Washington, DC; 1994.
23. Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation. Definition of mild traumatic brain injury. J Head Trauma Rehabil 1993;8(3):86–87.
24. Silverberg ND, Iverson GL, Group AMTDEC, et al. Expert panel survey to update the American Congress of Rehabilitation Medicine definition of mild traumatic brain injury. Arch Phys Med Rehabil 2021;102(1):76–86; doi: 10.1016/j.apmr.2020.08.022
25. Valera EM, Cao A, Pasternak O, et al. White matter correlates of mild traumatic brain injuries in women subjected to intimate-partner violence: a preliminary study. J Neurotrauma 2019;36(5):661–668; doi: 10.1089/neu.2018.5734
26. Matusz EC, Schaffer JT, Bachmeier BA, et al. Evaluation of nonfatal strangulation in alert adults. Ann Emerg Med 2020;75(3):329–338; 10.1016/j.annemergmed.2019.07.018
27. Tesch B, Bekerian D, English P, et al. Same-sex domestic violence: why victims are more at risk. Int. J Police Sci Manag 2010;12(4):526–535.
28. Patch M, Anderson JC, Campbell JC. Injuries of women surviving intimate partner strangulation and subsequent emergency health care seeking: an integrative evidence review. J Emerg Nurs 2018;44(4):384–393; doi: 10.1016/j.jen.2017.12.001
29. Vranda MN, Kumar CN, Muralidhar D, et al. Barriers to disclosure of intimate partner violence among female patients availing services at tertiary care psychiatric hospitals: a qualitative study. J Neurosci Rural Pract 2018;9(3):326–330; doi: 10.4103/jnrp.jnrp_14_18
30. Goodman L, Bennett L Dutton, MA. Obstacles to domestic violence victims' cooperation with the criminal prosecution of their abusers: the role of social support. Violence Vict 1999:427–444.
31. Strack GB, McClane GE, Hawley D. A review of 300 attempted strangulation cases. Part I: criminal legal issues. J Emerg Med 2001;21(3):303–309; doi: 10.1016/s0736-4679(01)00399-7
32. Toccalino D, Haag HL, Estrella MJ, et al. The intersection of intimate partner violence and traumatic brain injury: findings from an emergency summit addressing system-level changes to better support women survivors. J Head Trauma Rehabil 2022;37(1):E20–E29; doi: 10.1097/HTR.0000000000000743
33. Bergin A, Blumenfeld E, Anderson JC, et al. Describing nonfatal intimate partner strangulation presentation and evaluation in a community-based hospital: partnerships between the emergency department and in-house advocates. J Head Trauma Rehabil 2022;37(1):5–14; doi: 10.1097/HTR.0000000000000742
34. Patch M, Farag YMK, Anderson JC, et al. United States ED visits by adult women for nonfatal intimate partner strangulation, 2006 to 2014: prevalence and associated characteristics. J Emerg Nurs 2021;47(3):437–448; doi: 10.1016/j.jen.2021.01.008
35. Goldin Y, Haag HL, Trott CT. Screening for history of traumatic brain injury among women exposed to intimate partner violence. PM R 2016;8(11):1104–1110; doi: 10.1016/j.pmrj.2016.05.006
36. Flanagan SR, Cantor JB, Ashman TA. Traumatic brain injury: future assessment tools and treatment prospects. Neuropsychiatr Dis Treat 2008;4(5):877–892; doi: 10.2147/ndt.s1985.
37. Bogner J, Corrigan JD. Reliability and predictive validity of the Ohio State University TBI identification method with prisoners. J Head Trauma Rehabil 2009;24(4):279–291; doi: 10.1097/HTR.0b013e3181a66356
38. Corrigan JD, Bogner J. Initial reliability and validity of the Ohio State University TBI Identification Method. J Head Trauma Rehabil 2007;22(6):318–329; doi: 10.1097/01.HTR.0000300227.67748.77
39. Dams-O'Connor K, Cantor JB, Brown M, et al. Screening for traumatic brain injury: findings and public health implications. J Head Trauma Rehabil 2014;29(6):479–489; doi: 10.1097/HTR.0000000000000099
40. Fortier CB, Amick MM, Grande L, et al. The Boston Assessment of Traumatic Brain Injury-Lifetime (BAT-L) semistructured interview: evidence of research utility and validity. J Head Trauma Rehabil 2014;29(1):89–98; doi: 10.1097/HTR.0b013e3182865859
41. Moyer VA; U.S. Preventive Services Task Force. Screening for glaucoma: U.S. Preventive Services Task Force Recommendation Statement. Ann Intern Med 2013;159(7):484–489; doi: 10.7326/0003-4819-159-6-201309170-00686
42. Institute of Medicine. Clinical Preventive Services for Women: Closing the Gaps. Washington, DC: National Academies Press: Washington, D.C.; 2011; p. 249.
43. Dichter ME, Wagner C, Goldberg EB, et al. Intimate partner violence detection and care in the Veterans Health Administration: patient and provider perspectives. Womens Health Issues 2015;25(5):555–560; doi: 10.1016/j.whi.2015.06.006
44. Fingerhut LA, Rand MR, Saltzman LE, et al. Building data systems for monitoring and responding to violence against women; recommendations from a workshop. MMWR Recomm Rep 2000;49(RR-11):1–16.
45. Waalen J, Goodwin MM, Spitz AM, et al. Screening for intimate partner violence by health care providers. Barriers and interventions. Am J Prev Med 2000;19(4):230–237; doi: 10.1016/s0749-3797(00)00229-4
46. Plichta SB. Interactions between victims of intimate partner violence against women and the health care system: policy and practice implications. Trauma Violence Abuse 2007;8(2):226–239; doi: 10.1177/1524838007301220.
47. Chamberlain L, Perham-Hester KA. The impact of perceived barriers on primary care physicians' screening practices for female partner abuse. Women Health 2002;35(2-3):55–69; doi: 10.1300/J013v35n02_04
48. Huecker MR KK, Jordan GA, et al. Domestic Violence. Treasure Island, FL: StatPearls Publishing; Updated 2021, Aug 26. Available from: https://www.ncbi.nlm.nih.gov/books/NBK499891 [Last accessed: December 9, 2022].
49. Sullivan CM, Hagen LA. Survivors' opinions about mandatory reporting of domestic violence and sexual assault by medical professionals. Feminist Inquiry Soc Work 2005;20(3):346–361; https://doi.org/10.1177/088610990527
50. Sprague S, Madden K, Simunovic N, et al. Barriers to screening for intimate partner violence. Women Health 2012;52(6):587–605; doi: 10.1080/03630242.2012.690840
51. Sprague S, Madden K, Dosanjh S, et al. Screening for intimate partner violence in orthopedic patients: a comparison of three screening tools. J Interpers Violence 2012;27(5):881–898.
52. Phelan MB. Screening for intimate partner violence in medical settings. Trauma Violence Abuse 2007;8(2):199–213; doi: 10.1177/0886260511423246
53. Chang JC, Decker MR, Moracco KE, et al. Asking about intimate partner violence: advice from female survivors to health care providers. Patient Educ Couns 2005;59(2):141–147; doi: 10.1016/j.pec.2004.10.008
54. Sherin KM, Sinacore JM, Li XQ, et al. HITS: a short domestic violence screening tool for use in a family practice setting. Fam Med 1998;30(7):508–512.
55. Straus MA, Hamby SL, Boney-McCoy SUE, et al. The Revised Conflict Tactics Scales (CTS2): development and preliminary psychometric data. J Fam Issues 1996;17(3):283–316; doi: 10.1177/019251396017003001
56. Coker AL, Pope BO, Smith PH, et al. Assessment of clinical partner violence screening tools. J Am Med Womens Assoc (1972) 2001;56(1):19–23.
57. Feldhaus KM, Koziol-McLain J, Amsbury HL, et al. Accuracy of 3 brief screening questions for detecting partner violence in the emergency department. JAMA 1997;277(17):1357–1361.
58. Brown JB, Lent B, Brett PJ, et al. Development of the Woman Abuse Screening Tool for use in family practice. Fam Med 1996;28(6):422–428.
59. Donnelly KT, Donnelly JP, Dunnam M, et al. Reliability, sensitivity, and specificity of the VA traumatic brain injury screening tool. J Head Trauma Rehabil 2011;26(6):439–453; doi: 10.1097/HTR.0b013e3182005de3
60. Iverson KM, Dardis CM, Pogoda TK. Traumatic brain injury and PTSD symptoms as a consequence of intimate partner violence. Compr Psychiatry 2017;74:80–87; doi: 10.1016/j.comppsych.2017.01.007
61. Haag HL, Sokoloff S, MacGregor N, et al. Battered and brain injured: assessing knowledge of traumatic brain injury among intimate partner violence service providers. J Womens Health (Larchmt) 2019;28(7):990–996; doi: 10.1089/jwh.2018.7299
62. Edlow BL, Keene CD, Perl DP, et al. Multimodal characterization of the late effects of traumatic brain injury: a methodological overview of the late effects of Traumatic Brain Injury Project. J Neurotrauma 2018;35(14):1604–1619; doi: 10.1089/neu.2017.5457

63. Manoranjan B, Scott T, Szasz OP, et al. Prevalence and perception of intimate partner violence-related traumatic brain injury. J Head Trauma Rehabil 2022;37(1):53–61; doi: 10.1097/HTR.0000000000000749
64. Alves W, Macciocchi SN, Barth Jeffrey T. Postconcussive symptoms after uncomplicated mild head injury. J Head Trauma Rehabil 1993;8(3):48–59.
65. BIAo A. BIAA adopts new TBI definition 2011. Available from: http://www.biausa.org/announcements/biaa-adopts-new-tbi-definition [Last accessed December 15, 2022].
66. Centers for Disease Control and Prevention. Basic information about traumatic brain injury and concussion 2016. Available from: https://www.cdc.gov/traumaticbraininjury/basics.html [Last accessed: December 15,2022].
67. Management of Concussion/mTBI Working Group. VA/DoD Clinical practice guideline for management of concussion/mild traumatic brain injury. J Rehabil Res Dev 2009;46(6):CP1–CP68.
68. Gordon WA, Haddad L, Brown M, et al. The sensitivity and specificity of self-reported symptoms in individuals with traumatic brain injury. Brain Inj 2000;14(1):21–33.
69. ENIGMA Brain Injury: University of Southern California. Available from: http://enigma.ini.usc.edu/ongoing/enigma-tbi [Last accessed December 16, 2022.
70. Iverson KM, Dardis CM, Grillo AR, et al. Associations between traumatic brain injury from intimate partner violence and future psychosocial health risks in women. Compr Psychiatry 2019;92:13–21; doi: 10.1016/j.comppsych.2019.05.001
71. Anglin D, Sachs C. Preventive care in the emergency department: screening for domestic violence in the emergency department. Acad Emerg Med 2003;10(10):1118–1127; doi: 10.1111/j.1553-2712.2003.tb00585.x
72. Hewitt LN, Bhavsar P, Phelan HA. The secrets women keep: intimate partner violence screening in the female trauma patient. J Trauma Acute Care Surg 2011;70(2):320–323; doi: 10.1097/TA.0b013e31820958d3
73. Corrigan JD, Bogner J, Mellick D, et al. Prior history of traumatic brain injury among persons in the Traumatic Brain Injury Model Systems National Database. Arch Phys Med Rehabil 2013;94(10):1940–1950; doi: 10.1016/j.apmr.2013.05.018
74. Dams-O'Connor K, Spielman L, Singh A, et al. The impact of previous traumatic brain injury on health and functioning: a TRACK-TBI study. J Neurotrauma 2013;30(24):2014–2020; doi: 10.1089/neu.2013.3049
75. Dams-O'Connor K, Gibbons LE, Bowen JD, et al. Risk for late-life re-injury, dementia and death among individuals with traumatic brain injury: a population-based study. J Neurol Neurosurg Psychiatry 2013;84(2):177–182; doi: 10.1136/jnnp-2012-303938
76. Services USP. Intimate Partner Violence, Elder Abuse, and Abuse of Vulnerable Adults: Screening 2018. Available from: https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/intimate-partner-violence-and-abuse-of-elderly-and-vulnerable-adults-screening [Last accessed December 14, 2022].
77. Ansara DL, Hindin MJ. Formal and informal help-seeking associated with women's and men's experiences of intimate partner violence in Canada. Soc Sci Med 2010;70(7):1011–1018; doi: 10.1016/j.socscimed.2009.12.009
78. Wright EN, Anderson J, Phillips K, et al. Help-seeking and barriers to care in intimate partner sexual violence: a systematic review. Trauma Violence Abuse 2022;23(5):1510–1528; doi: 10.1177/1524838021998305
79. Wolf M, Ly U, Hobart M, et al. Barriers to seeking police help for intimate partner violence. J Family Violence 2003;18:121–129.
80. Wadman MC, Muelleman RL. Domestic violence homicides: ED use before victimization. Am J Emerg Med 1999;17(7):689–691; doi: 10.1016/s0735-6757(99)90161-4
81. Colantonio A, Valera EM. Brain injury and intimate partner violence. J Head Trauma Rehabil 2022;37(1):2–4; doi: 10.1097/HTR.0000000000000763
82. Peltz CB, Gardner RC, Kenney K, et al. Neurobehavioral characteristics of older veterans with remote traumatic brain injury. J Head Trauma Rehabil 2017;32(1):E8–E15; doi: 10.1097/HTR.0000000000000245
83. Himanen L, Portin R, Isoniemi H, et al. Longitudinal cognitive changes in traumatic brain injury: a 30-year follow-up study. Neurology 2006;66(2):187–192; doi: 10.1212/01.wnl.0000194264.60150.d3
84. Colantonio A, Ratcliff G, Chase S, et al. Aging with traumatic brain injury: long-term health conditions. Int J Rehabil Res 2004;27(3):209–214; doi: 10.1097/00004356-200409000-00006
85. Millis SR, Rosenthal M, Novack TA, et al. Long-term neuropsychological outcome after traumatic brain injury. J Head Trauma Rehabil 2001;16(4):343–355; doi: 10.1097/00001199-200108000-00005
86. Koskinen S. Quality of life 10 years after a very severe traumatic brain injury (TBI): the perspective of the injured and the closest relative. Brain Inj 1998;12(8):631–648; doi: 10.1080/026990598122205
87. Testa JA, Malec JF, Moessner AM, et al. Predicting family functioning after TBI: impact of neurobehavioral factors. J Head Trauma Rehabil 2006;21(3):236–247; doi: 10.1097/00001199-200605000-00004
88. Olver JH, Ponsford JL, Curran CA. Outcome following traumatic brain injury: a comparison between 2 and 5 years after injury. Brain Inj 1996;10(11):841–848; doi: 10.1080/026990596123945
89. Dams-O'Connor K, Spielman L, Hammond FM, et al. An exploration of clinical dementia phenotypes among individuals with and without traumatic brain injury. NeuroRehabilitation 2013;32(2):199–209; doi: 10.3233/NRE-130838
90. Krauss JK. Movement disorders secondary to craniocerebral trauma. Handb Clin Neurol 2015;128:475–496; doi: 10.1016/B978-0-444-63521-1.00030-3
91. Gooijers J, Beets IA, Albouy G, et al. Movement preparation and execution: differential functional activation patterns after traumatic brain injury. Brain 2016;139(Pt 9):2469–2485; doi: 10.1093/brain/aww177
92. Walker WC, Pickett TC. Motor impairment after severe traumatic brain injury: a longitudinal multicenter study. J Rehabil Res Dev 2007;44(7):975–982; doi: 10.1682/jrrd.2006.12.0158
93. Williams G, Galna B, Morris ME, et al. Spatiotemporal deficits and kinematic classification of gait following a traumatic brain injury: a systematic review. J Head Trauma Rehabil 2010;25(5):366–3674; doi: 10.1097/HTR.0b013e3181cd3600
94. Ponsford JL, Downing MG, Olver J, et al. Longitudinal follow-up of patients with traumatic brain injury: outcome at two, five, and ten years post-injury. J Neurotrauma 2014;31(1):64–77; doi: 10.1089/neu.2013.2997
95. Crane PK, Gibbons LE, Dams-O'Connor K, et al. Association of traumatic brain injury with late-life neurodegenerative conditions and neuropathologic findings. JAMA Neurol 2016;73(9):1062–1069; doi: 10.1001/jamaneurol.2016.1948
96. Gardner RC, Peltz CB, Kenney K, et al. Remote traumatic brain injury is associated with motor dysfunction in older military veterans. J Gerontol A Biol Sci Med Sci 2017;72(9):1233–1238; doi: 10.1093/gerona/glw341
97. Gardner RC, Byers AL, Barnes DE, et al. Mild TBI and risk of Parkinson disease: a Chronic Effects of Neurotrauma Consortium Study. Neurology 2018;90(20):e1771–e1779; doi: 10.1212/WNL.0000000000005522
98. Mahar I, Alosco ML, McKee AC. Psychiatric phenotypes in chronic traumatic encephalopathy. Neurosci Biobehav Rev 2017;83:622–630; doi: 10.1016/j.neubiorev.2017.08.023
99. Stern RA, Daneshvar DH, Baugh CM, et al. Clinical presentation of chronic traumatic encephalopathy. Neurology 2013;81(13):1122–1129; doi: 10.1212/01.wnl.0000457270.13076.80
100. Gardner A, Iverson GL, McCrory P. Chronic traumatic encephalopathy in sport: a systematic review. Br J Sports Med 2014;48(2):84–90; doi: 10.1136/bjsports-2013-092646
101. Schirinzi T, Grillo P, Di Lazzaro G, et al. Effects of head trauma and sport participation in young-onset Parkinson's disease. J Neural Transm (Vienna) 2021;128(8):1185–1193; doi: 10.1007/s00702-021-02370-8
102. Dams-O'Connor K, Cantor JB, Brown M, et al. Screening for traumatic brain injury: findings and public health implications. J Head Trauma Rehabil 2014;29(6):479–489; doi: 10.1097/HTR.0000000000000099
103. Cherry JD, Tripodis Y, Alvarez VE, et al. Microglial neuroinflammation contributes to tau accumulation in chronic traumatic encephalopathy. Acta Neuropathol Commun 2016;4(1):112; doi: 10.1186/s40478-016-0382-8
104. Alosco ML, Mez J, Tripodis Y, et al. Age of first exposure to tackle football and chronic traumatic encephalopathy. Ann Neurol 2018;83(5):886–901; doi: 10.1002/ana.25245
105. Alosco ML, Stein TD, Tripodis Y, et al. Association of white matter rarefaction, arteriolosclerosis, and tau with dementia in chronic traumatic encephalopathy. JAMA Neurol 2019;76(11):1298–1308; doi: 10.1001/jamaneurol.2019.2244
106. Adams JW, Alvarez VE, Mez J, et al. Lewy body pathology and chronic traumatic encephalopathy associated with contact sports. J Neuropathol Exp Neurol 2018;77(9):757–768; doi: 10.1093/jnen/nly065

107. Renker PR. Breaking the barriers: the promise of computer-assisted screening for intimate partner violence. J Midwifery Womens Health 2008;53(6):496–503; doi: 10.1016/j.jmwh.2008.07.017
108. Rodriguez MA, Bauer HM, McLoughlin E, et al. Screening and intervention for intimate partner abuse: practices and attitudes of primary care physicians. JAMA 1999;282(5):468–474; doi: 10.1001/jama.282.5.468
109. Hindin PK. Intimate partner violence screening practices of certified nurse-midwives. J Midwifery Womens Health 2006;51(3):216–221; doi: 10.1016/j.jmwh.2005.10.001
110. World Health Organization. Global Programme on Evidence for Health P. Putting women first: ethical and safety recommendations for research on domestic violence against women. World Health Organization: Geneva; 2001.
111. World Health Organization. Responding to intimate partner violence and sexual violence against women: WHO clinical and policy guidelines. Geneva: World Health Organization: Geneva; 2013.
112. World Health Organization. Violence Against Women 2021 [updated March 9th, 2021. Available from https://www.who.int/news-room/fact-sheets/detail/violence-against-women [Last accessed December 17, 2022].
113. Davis M, Padilla-Medina DM. Brief intimate partner violence perpetration screening tools: a scoping review. Trauma Violence Abuse 2021;22(4):900–913; doi: 10.1177/1524838019888545
114. Costello K, Greenwald BD. Update on domestic violence and traumatic brain injury: a narrative review. Brain Sci 2022;12(1):122; doi: 10.3390/brainsci12010122
115. Kogan AC, Rosen T, Navarro A, et al. Developing the geriatric injury documentation tool (Geri-IDT) to improve documentation of physical findings in injured older adults. J Gen Intern Med 2019;34(4):567–574; doi: 10.1007/s11606-019-04844-8
116. Stephenson R, Todd K, Gamarel KE, et al. Development and validation of a scale to measure intimate partner violence among transgender and gender diverse populations: protocol for a linear three-phase study (Project Empower). JMIR Res Protoc 2020;9(11):e23819; doi: 10.2196/28614
117. Valera EM. When pandemics clash: gendered violence-related traumatic brain injuries in women since COVID-19. EClinicalMedicine 2020;24:100423; doi: 10.1016/j.eclinm.2020.100423
118. Centers for Disease Control and Prevention. Victimization of persons with traumatic brain injury or other disabilities: a fact sheet for professionals US Department of Health and Human Services/CDC2017. Available from: https://www.cdc.gov/traumaticbraininjury/pdf/VictimizationPerson_Fact%20Sheet4FrdsFal-a.pdf [Last accessed November 19, 2022].
119. Petersilia JR. Crime victims with developmental disabilities: a review essay. Criminal Justice Behav 2001;28(6):655–694.
120. Brown H, Turk V. Sexual abuse in adulthood: ongoing risks for people with learning disabilities. Child Abuse Rev 1994;3(1):26–35.
121. Colantonio A, Kim H, Allen S, et al. Traumatic brain injury and early life experiences among men and women in a prison population. J Correct Health Care 2014;20(4):271–279; doi: 10.1177/1078345814541529
122. Tsukada M, Yoshida K, Colantonio A, et al., editors. Women living with acquired brain injury: pilot study of community health and well-being needs. Brain Inj 2012;26(4-5)774–775.