Exploring correlates of probably traumatic brain injury among intimate partner violence survivor

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Abstract:

Although intimate partner violence (IPV) related (TBI) is increasingly recognized as an important area of concern, there is no existing research that seeks to identify correlates of IPV related TBI. Given the profound consequences of TBI, it is important to identify individual and social-ecological conditions that are associated with probable TBI among persons with a history of physical violence in their intimate partnerships. In this paper, we are concerned specifically with physical abuse that occurs in violent intimate relationships. The sample included 130 participants who were formerly abused by an intimate partner. This study was part of a larger research project that utilized a web-based survey to learn about the socio-ecological conditions surrounding IPV-related TBI. The HELPS screening tool was employed to calculate risk for TBI. Approximately half of the survey respondents (n= 64) were determined to have likely experienced IPV-related TBI. This finding is consistent with existing literature showing that TBIs are highly prevalent among individuals who have experienced IPV. Logistic regression analysis was used to explore the correlates of IPV-related TBI. The results show that punishment for the abuser, time since the relationship ended, and seeking help for the health consequences of IPV were significantly associated with probable TBI. Results, limitations, future directions and implications are discussed.

Keywords: Traumatic brain injury | HELPS screening tool | intimate partner violence | abuse | domestic violence survivors | partner abuse | concussion

Article:

Introduction

Intimate partner violence (IPV) is a common, widespread social problem with potentially devastating consequences (Tjaden & Thoennes, 2000). The Centers for Disease Control (2010)

estimates that 24.3% (or 1 in 4) women and 13.8% (1 in 7) men have experienced severe physical violence from an intimate partner in their lifetimes. Intimate partner violence may lead to a whole host of physical, emotional and cognitive impairments, including traumatic brain injury (TBI) (Ellsberg, Jansen, Heise, Watts, & Garcia-Moreno, 2008; Plichta, 2004). Because TBI – and especially mild TBI (mTBI) – is often less visible than other forms of IPV-related injuries (e.g., bruises or broken bones), these injuries may go undetected and untreated despite symptoms that may last for days or months following the injury (Corrigan, Wolfe, Mysiw, Jackson, & Bogner, 2001; Valera & Berenbaum, 2003). Indeed, individuals living with mTBI may not know it themselves. People who exist in violent partnerships may sustain injuries on a regular basis, a situation which is particularly urgent because multiple TBIs, without the benefit of healing, results in longer recovery times and potentially more severe consequences than having only one injury (Rapoport, McCullagh, Shammi, & Feinstein, 2005; Valera & Berenbaum, 2003). Further, these injuries could have a cyclical and cumulative effect where the cognitive, physical, and emotional symptoms associated with TBI may trigger a greater risk for future violence, including additional TBIs.

Intimate partner violence describes "any form of physical, sexual, emotional, psychological, and/or verbal abuse between partners in an (current or former) intimate relationship" (Murray & Graves, 2012, p. 14). A TBI is an injury which disrupts the normal functioning of the brain. The result of such disruption may include changes in physical, cognitive and/or emotional wellbeing. A TBI is, in most cases, caused by a blow to the head, face or neck. TBI severity is classified as mild, moderate, or severe depending on the symptoms. Mild TBI (mTBI) is the most frequently occurring brain injury. Mild TBIs are the most difficult type to detect due to the subtle nature of symptoms (American Congress of Rehabilitation Medicine, 1993).

The topic of IPV-related TBI is relatively new to the existing research literature (Hunnicutt, Lundgren, Murray, & Olson, 2017; Ivany & Schminkey, 2016). At the time of this writing, there were fewer than 20 published articles on TBI that occurs in the context of IPV. While IPV may result in an array of serious injuries, TBI is among the most devastating (Reichard, Langlois, Sample, Wald, & Pickelsiner, 2007). Individuals who live with TBI-related disabilities may experience altered physical and cognitive functions, which may compromise their capacity to stay safe (Diaz-Olavarrieta, Campbell, de la Cadena, Paz, & Villa, 1999). When compared with able-bodied persons, people with disabilities are at a higher risk of violent victimization (Hughes et al., 2012; Reichard et al., 2007).

Despite growing recognition of the risk for TBI among people who have experienced IPV, IPV-related TBI is rarely addressed in professional training programs for front-line staff who work with individuals experiencing IPV (Ackerman & Banks, 2003; Banks & Ackerman, 2002). In fact, recent research has revealed that many professionals do not inquire about the possibility of TBI when those who experience IPV seek help (Crowe et al., 2018). IPV-related TBI may elude first responders and may be unknown to the survivor living with the injury. IPV related TBI is not commonly integrated into the general scholarly literature on domestic violence, violence against women, gender violence, and intimate partner violence. Finally, a review of the literature shows that IPV researchers have yet to identify key correlates for IPV related TBI.

IPV-related TBI

The few existing studies that sought to document the rate of IPV-related TBI all report an alarmingly high incidence of TBI among individuals with a history of IPV. Among a national sample of U.S. women veterans, Iverson, Dardis, and Pogoda (2017) discovered that 28% of web survey respondents had a history of IPV-related TBI. Kwako et al. (2011) estimate that IPV-related TBI ranges from 30% to 74% . Valera and Berenbaum (2003) found nearly 75% of women from both shelter and non-shelter populations reported an IPV-related TBI. Monahan and O'Leary (1999) discovered a 35% IPV-related TBI prevalence rate among women residing in shelters. In another study, emergency room data revealed that 67% of women treated for IPV-related injuries reported problems that were indicative of injuries to the head (Corrigan et al., 2001). Iverson et al. (2018) found that 63.0% of female military veterans who screened positive for TBI reported IPV at some point during their lifetime. In their sample of 20 women who had experienced IPV, Valera and Kucyi (2017) found that all of the participants in their sample reported at least one IPV-related TBI, while 75% reported multiple TBIs.

It is common for individuals who experience IPV to acknowledge being hit in the face, neck, and head (Ackerman & Banks, 2003; Corrigan et al., 2001). Indeed, between 88% to 94.4% of physical IPV incidents involve injuries to the head and neck (Arosarena, Fritsch, Hseueh, Aynechichi, & Haug, 2009), resulting in a greater likelihood of TBI. Jackson, Philp, Nuttall, and Diller (2002) found that 92% of women in their sample who had experienced IPV had been hit in the head by their partners. A still strikingly large number, 83%, had been both severely shaken and hit in the head. These same researchers also uncovered that 8% of women in their sample had been hit in the head over 20 times in the past year. Mechanic, Weaver, and Resick (2008) found that 46% of their sample reported being hit in the head during an IPV attack, 45% reported loss of consciousness associated with IPV incidents, and 72% reported strangulation. Mechanic et al. (2008) also discovered that the severity of the injury was connected to the length of the abusive relationship and the severity of physical aggression. These collective findings demonstrate that TBIs are highly prevalent among individuals who have experienced IPV and that those who experience physical abuse are very likely to be hit in the head, neck, and face. The next step in addressing this problem is to identify those individuals, social-ecological correlates that are associated with IPV related TBI (Bronfenbrenner, 1979).

TBI in violent partnerships

Traumatic brain injury, especially when it is categorized as mild or chronic, can be an elusive injury, invisible and difficult to detect (Roberts & Kim, 2005). Individuals with IPV-related TBI may experience significant functional consequences without any visible injuries. These less visible injuries and other consequences of IPV-related TBI might be trivialized or dismissed. The culture of silence and stigma surrounding IPV prevents accurate diagnoses and intervention for IPV-related TBI (Crowe & Murray, 2015). In addition, the negative health impacts become more serious with the increased frequency and severity of violence (Campbell, 2002).

Chronic stress may be both a precursor and overlapping condition that co-occurs with IPV-related TBI. Existing in a violent social arrangement makes coping with the effects of a TBI challenging at best, and exacerbating the effects of the injury at worst. Covassin and Bay (2011) found that as chronic stress levels increased, female patients with mTBI exhibited a worsening of

verbal memory, motor processing speed, and reaction time. Depending on the extent and severity, TBI sequelae could make it difficult to cope with everyday functional tasks, make good personal decisions, or organize and sequence daily activities. These symptoms present many potential challenges for those who are attempting to disconnect from violent partners and establish safety in their lives (Jackson et al., 2002).

The symptoms associated with mTBI are difficult to identify and far more likely to escape attention. It is also difficult to tease out the consequences of mTBI from other symptoms related to the IPV experience. For example, some researchers argue that the severity and psychological trauma of just living in an abusive relationship may account for changes in one's cognition and psychological functioning (Houskamp & Foy, 1991), making it even harder to separate mTBI from other physical and mental health problems. Both exposure to a violent situation and sustaining a TBI may contribute directly and indirectly to cognitive and psychological dysfunctioning. (Valera & Berenbaum, 2003). For practitioners, in particular, there is limited guidance available to help them tease apart all of these overlapping symptoms that may result from the stress of the abuse itself, injuries, psychological effects of the abuse, and potential TBI (Murray, Lundgren, Olson, & Hunnicutt, 2016), and many professionals are not assessing for TBI when survivors do seek help (Crowe et al., 2018).

The purpose of this paper is to explore the correlates of IPV-related TBI. Given the profound consequences of TBI, it is important to identify individual and social-ecological conditions that are associated with TBI among individuals who have experienced a history of physical violence in their intimate partnerships. In this paper, we are concerned specifically with physical abuse that occurs in violent intimate relationships. The research questions are as follows:

R1: What is the proportion of survivors in this sample who are "at risk" for TBI history stemming from IPV attacks as determined using the HELPS screening tool?

R2: What individual, relationship and socio-ecological characteristics correlate with TBI risk among individuals who have experienced IPV?

Method

Sample recruitment strategies

This study was part of a larger survey-based research project that utilized an electronic survey to learn about the socio-ecological conditions surrounding IPV-related TBI. The target population for this study was survivors of past IPV. Participants were recruited based on the following criteria: (a) they were at least 21 years of age; (b) they were formerly abused by an intimate relationship partner (i.e., they had experienced intimate partner violence, including any form of physical, emotional, psychological, verbal, and/or sexual abuse in the context of a relationship with an intimate partner, such as a boyfriend or girlfriend, life partner, or spouse); (c) they had been out of any abusive relationship for at least two years; and (d) they were able to complete the electronic survey, which was written in the English language. To minimize the likelihood that completing the survey would lead to emotional distress about their experiences of past abuse, respondents were required to have been out of any abusive relationship for at least two years. We

also reasoned that a period of two years would provide time for participants to have processed their past experiences and would provide some distance from the crises and emotional reactions related to the abuse. Participants were also free to skip any questions that made them uncomfortable. As an additional protection for participants' emotional safety, respondents were provided with resources for crisis intervention should the survey trigger any distress.

A convenience sampling technique was employed to recruited participants for this study using the following strategies: (a) sharing invitations via email to personal and professional contacts, (b) posting notices about the survey on electronic message boards and Facebook pages that are relevant to the target population and (c) disseminating notices about the study through the website and social media platforms maintained by two of the research team members. It is not possible to determine a response rate for this study given the nature of the participant recruitment strategies used nor is possible to determine the actual number of people who received the invitation to participate in one or more ways. Overall, the notice was posted on 94 different Facebook pages or internet-based discussion boards.

Procedures

All participants were asked to complete an electronic survey, which was designed by the researchers for the current study. The survey was hosted through Qualtrics, a secure, internet-based survey-hosting platform. Participants were required to answer a series of eligibility questions before they were able to access the full survey. Participants who did not meet the eligibility criteria were not allowed to access the survey, but they were provided with resources for information and support related to intimate partner violence even if they did not meet the criteria for participation. Participants who were deemed eligible to participate were then able to review and print a copy of the informed consent document. After they indicated that they had read and agreed with the terms of the informed consent document, they were taken to the survey. The survey was estimated to take approximately 30 min to complete, although participants who opted to provide more in-depth responses to the open-ended questions could take as long as they needed to complete the survey. Within both the informed consent document and at the end of the survey, all participants were provided with links for additional support or information about IPV, especially if participants experienced any emotional distress as a result of reporting on their previous experiences of having been abused in an intimate relationship.

The electronic survey was anonymous, and no identifying information was collected through the survey website. As an incentive for participation, all participants had the opportunity to enter a drawing for one of two $50 store gift cards if they completed the survey. Participants who were interested in entering the drawing were directed to a separate survey, in which they provided their email addresses. In this way, participants' responses to the survey were in no way linked to their identifying information provided in order to enter the drawing. A relatively small number of participants (n = 22) opted to enter the drawing. The two drawing winners were selected and notified after data collection was complete.

Instrumentation

This survey was designed by the authors of this paper. The survey questions were constructed based on existing literature on IPV and IPV-related TBI. Additionally, the questions were designed to prompt participants to provide information that would answer the study's research questions. The survey went through at least five iterations and revisions in the process of developing it for this study. This literature was used to identify key variables to assess. Following the development of the initial draft of the survey, the research team members revised the survey for clarity and to ensure alignment with the research questions through a series of face-to-face meetings and electronic communications. After three rounds of review and refinement, the survey was adapted to the electronic format, and two additional rounds of the review were conducted by the research team to ensure that the question formats used in the electronic survey were appropriate. Once a consensus was reached that the electronic survey was in its final form, it was submitted to the IRB for approval before being disseminated to potential participants.

On the survey, participants were asked to describe their demographic characteristics; their past experiences with IPV; their physical, cognitive, and mental health; and the broader needs of survivors of IPV. The first two sections of the survey (i.e., the demographics section and the section that addressed participants' past experiences with IPV) were drawn from prior survey instruments used by the two researchers in the series of studies that informed the social media campaign described above in the Sample Recruitment Strategies section. The remaining sections were developed anew for this study. The final three questions in this section asked about the financial impact of the IPV they experienced. Participants were also asked whether they received any sort of victim's compensation or reimbursement due to legal consequences for their abuser (e.g., if perpetrators were required to pay for medical bills) to cover any of the costs they described above related to their physical, mental, and/or cognitive costs. The final section of the survey included a series of five open-ended questions, which were aimed at understanding the strategies that survivors of IPV use to promote their own overall health and wellness, as well as to promote social awareness about IPV and support other survivors.

Determining IPV history

This section in the survey began with the following instructions: "This study is for individuals who have previously been in one or more intimate relationships (e.g., boyfriend/girlfriend, spouse, partner) in which they experienced intimate partner violence (IPV). Sometimes, IPV is referred to by other terms, such as domestic violence, battering, or spouse abuse. In this study, we are defining intimate partner violence (IPV) as any form of abuse and/or violence that occurs in an intimate relationship, including physical, emotional, psychological, verbal, and/or sexual abuse. In this section, we are interested in learning about the context of the relationship(s) in which you experienced IPV." The variables assessed in this section included the number of past relationships in which participants had experienced IPV and, for their most recent relationship that included any form of IPV, the following variables: (a) partner's gender; (b) duration of the relationship, in months and years; (c) most significant level of commitment with that partner; (d) the types of abuse they experienced (i.e., physical, emotional and/or verbal, sexual, and other types); (e) whether their former partner received any form of legal sanctions as a result of the abusive behaviors, (f) whether they had any children with this partner, (g) how the relationship ended, (g) whether they have any current contact with this partner, (h) length of time since the

relationship ended, and participants' perspectives on (i) the factors that impacted their abuse in the relationship, (j) their partners' beliefs about gender, (k) whether and how their freedom to make choices was compromised in the relationship, and (l) any other pertinent information not covered elsewhere. The final question in this section asked participants to briefly describe any other past violent or abusive relationships in which they were involved.

Participants' physical, cognitive, and mental health

This section asked participants a series of questions about their physical, cognitive, and mental health as it related to their experiences with IPV. Because participants may have been less familiar with the term, "cognitive health," we provided the following statement as context for these questions: "Please note: Some survivors of abuse experience changes in their thinking skills, attention, memory, and concentration following their experiences with abuse. When we refer to cognitive health below, we're interested in learning about any changes you may have noticed in your own ways of thinking. This may include memory loss, difficulty concentrating, and word finding problems." The questions included in this section included the following: (a) what, if any, pre-existing physical, cognitive, and mental health conditions participants had before they were involved in any abusive intimate relationships; (b) what, if any, physical, cognitive, and mental health conditions participants were diagnosed with during the time that they were involved in any abusive relationships; (c) if participants experienced any physical violence in the past abusive relationships, the parts of their body toward which the violence was directed (i.e., head, face, neck – including choking and strangulation, chest or shoulders, arms or hand, back, abdomen and digestive system, reproductive system – including any sexually transmitted infections and/or pregnancy-related concerns, legs, buttocks, and feet, and/or other; and (d) the frequency, severity, and whether treatment was sought for any of the injuries noted in item (c).

The next part of this section presented participants with a matrix in which participants were asked to report whether they experienced any of a list of specified symptoms (whether or not they had received an official diagnosis for any physical, cognitive, and mental health conditions) at three time frames (i.e., at any time during the abusive relationship; within the last six months from the time completing survey, and at any time since the abusive relationship ended. For any symptoms that participants reported experiencing, they were asked to rate how severe that symptom was on a scale from 1 to 5, where 1 = mild, 3 = moderate, and 5 = severe. The symptoms assessed included the following: nausea, vomiting, sensitivity to light, dizziness, headaches, difficulty balancing, ringing in their ears, anxiety/excessive worry, depressed mood, irritability, lack of motivation, lower appetite, greater appetite, frequent crying, anger that they feel unable to control, flashbacks to the abuse, low self-esteem, negative body image, problems concentrating, difficulty finding the right words, difficulty remembering new information, problems organizing their thoughts, problems organizing daily activities, difficulty following through on daily tasks, difficulty following conversations, sexually transmitted infections, high blood pressure, and other (which participants were asked to specify. Next, participants were asked what, if any, ongoing chronic physical, cognitive, and mental health problems they have currently and believe are related to their experiences of IPV.

The next set of questions in the section asked participants about their experiences of seeking professional attention for any physical, cognitive, and mental health consequences of their abuse. These questions included (a) whether they sought professional attention for these consequences during the time they were involved in the relationship, (b) an estimate of approximately how many times they sought professional attention for any injuries or physical, cognitive, and mental health consequences of the abuse, (c) if they did not seek professional attention, their reasons for not doing so, (d) if they sought professional attention, the types of professionals whose services they sought (i.e., a clergy member, psychiatrist, substance abuse treatment center, domestic violence agency that provides treatment for mental health concerns, college counseling center, community health center or public health department, family physician, emergency room/department, dentist, brain injury rehabilitation specialist, counselor or therapist, or other. Participants who sought professional attention were then asked to describe which three of the above professionals were most helpful and which three were least helpful, and why they were or were not helpful. Next, participants were asked whether any of the professionals from whom they sought services talked with them about the possibility of a traumatic brain injury, and, if so, which professionals spoke with them about this and what they discussed.

The final section of the survey included a series of five open-ended questions, which were aimed at understanding the strategies that survivors of IPV use to promote their own overall health and wellness, as well as to promote social awareness about IPV and support other survivors. The questions included in this section were as follows: (a) What are the top three to five things you do currently to take care of your physical, mental, and cognitive health?; (b) What have been the biggest challenges you have faced in taking care of yourself physically and mentally following your experiences with IPV?; (c) What would be required to help survivors of relationship abuse feel more empowered? Please include changes that you think could be made locally and at the societal level to increase sensitivity and support for survivors of abuse; (d) What message would you want to send to people who have recently left an abusive relationship?; and (e) Please share any additional insights you would like to share about your experiences with overcoming past abuse that were not addressed elsewhere in this survey.

Determining risk for TBI Using HELPS screening tool

The construction of the binary dependent variable (at risk for TBI/not at risk for TBI) was determined by using participants' scores on the HELPS screening inventory (Picard, Scarisbrick, & Paluck, 1991). HELPS tool includes five questions and was developed for professionals whose primary field of practice is something other than TBI, so that they may assist in identifying those who may have sustained a TBI ("at risk") and refer them to a medical professional familiar with TBI for a medical diagnosis. The five questions are as follows:

1. Have you ever hit your Head or been hit on the head?
2. Were you ever seen in the emergency room, hospital, or by a doctor because of an injury to your head?
3. Did you ever lose consciousness or experience a period of being dazed and confused because of an injury to your head?
4. Do you experience any problems or have any symptoms since the injury? (a list of potential symptoms provided)

5. Any significant sicknesses?

The portion of our survey that addresses TBI was designed to elicit information pertaining to the five HELPS items. According to Picard et al. (1991), if the IPV survivor scores two or more points (i.e. answers two or more of the questions affirmatively), and particularly if symptoms/problems are evident, then there exists signs of possible injury, placing the person in an "at-risk" for brain injury category. For this study, we adopted the updated HELPS scoring guidelines from the CDC (2003). We considered survivor to be at risk for a TBI if s/he affirms the following:

1. A physical injury occurred to the head, neck or face,
2. There was a period of loss of consciousness or altered consciousness after the injury, and
3. Two or more cognitive or physical symptoms were present following the injury.

Participant 19 is an example of an individual placed at risk category after reviewing her survey responses. The participant is a 41-year-old female who reported being hit in the head, neck, and face by an intimate partner. This resulted in a subsequent alteration in consciousness. Following the incident, she reported nausea, vomiting, sensitivity to light, memory problems, and irritability. Respondents were specifically asked to report on being hit in the head, neck or face by an intimate partner to prevent confusing the injury from another source (e.g. accident, war, sports).

Three individuals (one faculty member and two graduate students) reviewed the data, using HELPS Screening and determined whether individuals were at risk or not. Intercoder reliability was 100%. We calculated that approximately half of the survey respondents were at risk for TBI (n = 64), while the other half were not characterized as at-risk for TBI (n = 66).

Data analyses

Explanatory variables

The explanatory variables chosen for analysis were selected in accordance with existing literature on IPV related TBI. The explanatory variables included age; race (collapsed into a binary category of white and nonwhite); education (collapsed into a binary category of high school or less or college); number of IPV relationships; duration of most recent IPV relationship; whether or not the abuser received punishment; whether or not the respondent had children with the abuser; years since the relationship ended; level of commitment (collapsed into a binary category of living together, not living together); whether or not the respondent sought help or intervention for the abuse; whether or not the respondent received compensation for the victimization; and whether or not the respondent also experienced sexual abuse.

Logistic regression analysis

In the first phase of the analysis, we ran collinearity tests. Next, we conducted multivariate logistic regression analysis using SPSS. In logistic regression models, the outcome variable is binary, or dichotomous (Hosmer, Lemeshow, & Sturdivant, 2013). In this case, the outcome

variable is TBI risk/Not TBI risk. These dichotomous categories were constructed using the HELPS screening tool.

Results

Descriptive statistics

A total of 130 participants completed the survey. The vast majority of participants were female (*n*= 124, 95.4%), with five males (3.8%), and one participant not reporting gender. The participants ranged in age from 21 to 75 years old (M = 40.50, SD = 10.37). Participants' current relationship statuses were as follows, in order from greatest to least: divorced (*n*= 33, 25.4%), married (*n*= 30, 23.1%), in a committed relationship and living together (*n*= 25, 19.2%), single (*n*= 21, 16.2%), in a committed relationship but not living together (*n*= 12, 9.2%), separated (*n*= 3, 2.3%), dating but not in a committed relationship (*n*= 1, 0.8%), and other (*n*= 5, 3.8%). Other current relationship status responses specified by participants included remarried, widowed/single, and engaged. Sixty-seven participants (51.5%) reported that their current partners are male, 6 (4.6%) reported having female partners, and 54 (41.5%) reported not being in a current intimate relationship.

The length of their most recent relationships ranged from 0 to 34 years (M = 8.29, SD = 7.14). The average length of time since participants' most recent abusive relationships ended was 6.9 years (SD = 6.00). Most of the participants (*n*= 104, 80.0%) reported that they had children, and 25 (19.2%) participants reported that they do not have any children.

Regarding ethnicity, the majority of participants (*n*= 103, 79.2%) were Caucasian/White. This was followed by participants who were Hispanic/Latino/Latina (*n*= 17, 13.1%), African American/Black (*n*= 7, 5.4%), Native American (*n*= 4, 3.1%), Asian (*n*= 3, 2.3%), and from other ethnic backgrounds (*n*= 2, 1.5%). The two responses for the "other" category were Jewish American and None. The highest levels of education completed by participants were as follows, in order from greatest to least percentages of the sample: high school diploma/GED (*n*= 35, 26.9%), graduate degree (*n*= 28, 21.5%), bachelor's degree (*n*= 26, 20.0%), associate's degree (*n*= 21, 16.2%), some high school but no degree (*n*= 3, 2.3%), and other (*n*= 17, 13.1%). Most participants reporting "other" educational attainment levels involved technical/trade education or some college. Participants were diverse with respect to current household income levels: under $15,000 (*n*= 33, 25.4%), $16,000 to $30,000 (*n*= 25, 19.2%), $31,000 to $60,000 (*n*= 36, 27.7%), $61,000 to $100,000 (*n*= 26, 20.0%), and over $100,000 (*n*= 10, 7.7%).

Participants were asked to describe their past experiences with IPV. The number of past relationships in which participants had experienced IPV ranged from 1 (*n*= 61, 46.9%) to 5 (*n*= 3, 2.3%) [Additional participants reported 2 (*n*= 45, 34.6%), 3 (*n*= 7, 5.4%), and 4 (*n*= 5, 3.8%) past abusive relationships]. Participants were then asked to respond to a series of questions about the most recent relationship in which they experienced IPV. The vast majority of participants (*n*= 115, 88.5%) reported that this partner was of a different gender, while five (3.8%) participants reported that the IPV occurred in a same-gender relationship. The highest levels of commitment that participants had with these partners was as follows: married (*n*= 30, 23.1%), in a committed relationship and living together (*n*= 30, 23.1%), in a committed relationship and not living

together (*n*= 11, 8.5%), dating but not committed (*n*= 3, 2.3%), in a legally recognized civil union but not married (*n*= 2, 1.5%), and other (*n*= 5, 3.8%). Responses in the "other" category included being engaged and sharing a child together.

Participants were asked to report the types of abuse they experienced in these relationships. Of those responding to these questions, nearly all reported having experienced emotional and/or psychological abuse (*n*= 120, 92.3%), and sexual (*n*= 84, 64.6%) abuse were reported at high rates as well. About half of the participants reported that their abusers had received any form of legal sanctions for the abuse they perpetrated (*n*= 67, 51.5%). The majority of participants (*n*= 71, 54.6%) reported that they had at least one child with this partner. Most participants indicated that they did not have any current contact with their former partners (*n*= 85, 65.4%), although a substantial number of participants did report such contact (*n*= 36, 27.7%). We calculated that approximately half of the survey respondents were at risk for TBI (*n* = 64), while the other half were characterized as not at-risk for TBI (*n* = 66).

Results of logistic regression

Table 1 summarizes the results of the multivariate logistic regression, reporting odds ratios and confidence intervals. The overall model is significant (with $p < .001$), and the Nagelkerke R Square is 34%. Of the 13 independent variables included in the model, three significantly increased the odds of a probable TBI. If the abuser received punishment, the odds of probable TBI were 3.719 higher among people who experienced intimate partner violence. The more time that passed since the abusive relationship ended also significantly increased the odds of probable TBI by 1.235. Finally, if the respondent sought the help they had 3.466 times the odds of probable TBI. The remaining variables were not statistically significant.

Table 1. Estimated likelihood of TBI among formerly abused survey respondents.

			95% C.I.for EXP(B)	
Independent Variables	**P-Value**	**OR**	**Lower**	**Upper**
Race	0.84			
Race (White)	0.999	0	0	
Race (NonWhite)	0.555	1.519	0.379	6.085
Number of IPV Relationships	0.473	1.208	0.721	2.024
Duration of Most Recent IPV Relationship in Years	0.96	1.002	0.921	1.091
Abuser Receive Punishment	0.008	3.719	1.407	9.829
Children with Abuser	0.071	0.366	0.123	1.089
Years Since Relationship Ended	0.002	1.235	1.083	1.408
Seek Help	0.024	3.466	1.177	10.212
Compensation	0.541	2.076	0.2	21.564
Level of Commitment	0.118	0.254	0.046	1.414
Education	0.904	0.93	0.285	3.038
Sexual Abuse	0.814	0.879	0.301	2.569
Age	0.143	0.624	0.332	1.172

Note. CI: Confidence Interval. OR: Odds Ratio

We performed multicollinearity and goodness of fit tests. We ran a correlation matrix to examine the multicollinearity among identified variables. We observed that most of these inter-correlations were relatively low and passed the tolerance test of the Variance Inflation Factor

(VIF). To determine the goodness of fit, a Homer–Leme show test was calculated. This test was not significant ($p > 0.05$), which indicated that the data provided a sound overall fit of the model.

Discussion and conclusion

This study sought to explore those correlates are associated with probable IPV-related TBI. In this study, "at-risk" is determined by using the HELPS tool. The descriptive findings in this study revealed that about half of all survey respondents ($n = 64$) were determined to be "at risk for TBI" based on criteria from the HELPS questionnaire. The language of "at risk" is consistent with the literature on HELPS. Further, multivariate analysis revealed significant correlates between probable TBI and seeking help, abuser being punished, and years since the relationship ended. Seeking help and abusers receiving punishment both signal formal interventions.

Of particular note is the significant relationship between probable TBI and the survivor seeking help to deal with the consequences of the abuse. On the one hand, this result is particularly good news, as it suggests that individuals in this sample were possibly more likely to receive treatment for their injuries and therefore possibly benefitted from the intervention that may have helped to extricate them from a dangerous relationship. On the other hand, this help-seeking result may signal that IPV survivors who are at a greater likelihood for TBI seek intervention because the abuse is quite extreme. In the qualitative results in this study, we did observe anecdotal evidence that the "at risk for TBI" group tended to report more violent, gruesome and escalated descriptions of violent attacks.

Valera and Berenbaum (2003) examined whether women in a sample of both shelter and non-shelter groups sustained brain injuries from their abusive partners. Their findings show that higher TBI severity scores were associated with higher partner abuse severity scores. Their findings suggest, as do ours, that the more severe the violence, the greater the chance of sustaining a TBI. That said, while these researchers found a correlation between the severity of abuse and TBI risk, the majority of their participants in their study did not seek medical intervention. Indeed, Valera and Berenbaum (2003) reported that a staggering 75% of their sample of IPV survivors did not seek any medical attention for any abuse-related injuries. Less than half reported going to the hospital for medical attention related to any partner-induced injuries ever. These researchers reported that only two women in their study sought medical attention for the reported TBIs they sustained.

The existing IPV literature is mixed with regard to whether or not IPV survivors seek help. Leone, Johnson, and Cohan (2007) found that individuals who had experienced intimate terrorism were more likely to get help. Meanwhile, IPV victims who experienced situational couple violence (Johnson, Leone, & Xu, 2014) were inclined to just seek support from friends and informal networks. In this case, intimate terrorism was the more serious form of violence, defined as violence that is an extension of power and control (Johnson et al., 2014). Situational couple violence was the less serious form of violence, which took place in situationally specific conflict rather than stemming from more generalized power and control dynamics. While Leone et al. (2007) determined that the type of violence impacted whether or not IPV survivors sought help, Ivany et al. (2018) in their study of IPV related TBI, found that many women disclosed some fear surrounding getting medical treatment. This fear included feeling judged for their

history of IPV and fear of others learning about their permanent disability stemming from the abuse.

Even in the best case scenario where IPV survivors do seek medical attention, it is possible that the TBI would be missed or that relevant information about TBI symptoms would not be collected, as suggested by earlier studies (Crowe et al., in press). Indeed, our study did not confirm whether or not our respondents received help for a possible TBI. The existing literature, including the results of this study, leave us with this vexing conclusion: is not clear how many women who suffer single or repeated blows to the face and head seek medical treatment.

One pioneering model to address this problem is being practiced in Phoenix, AZ. Zieman, Bridwell, and Cárdenas (2017) participate in a neurology practice that specializes in TBI. Since 2012 this clinic in Phoenix, AZ established a partnership with five community domestic violence and homeless shelters in the area. New residents are given the HELPS brain injury screening tool when they enter these shelters. Those individuals who screen positive for suspected brain injury are then referred to this clinic for further neurological intervention. While this model only captures survivors who get to a shelter, it is a promising intervention for the shelter-based population.

The significant association between help-seeking and probable TBI in this study could be related to social class and race composition of our sample. Over half of the respondents in this survey made more than $30,000 annually and nearly 80% of the sample was white – a demographic already likely to access medical services and very likely already under medical supervision. For future studies, researchers might tease out IPV-related TBI likelihood among individuals who are already receiving health care versus those who are not, and endeavor to uncover what prevents IPV survivors from getting health care.

While this study did not find demographic indicators to be significant, the entire sample tended to by older white females. The mean age was 40 and respondents had been out of their abusive relationship an average of six years. Future researchers should aim to construct a sample that is more representative of the overall IPV population.

These preliminary findings suggest the importance of additional research on this population and the need to find effective intervention tools to identify and treat individuals for probable IPV related TBI. This study is the first to identify key individual and socio-ecological factors that correlate with likely IPV related TBI. Since this study is the first of its kind, we cannot compare the results to other studies for consistency. The results suggest that if the violence was severe enough to warrant criminal justice intervention, where the abuser was punished, the odds of probable TBI increased. The more time that had passed since the violence partnership ended was also significantly associated with increased odds of IPV related TBI likelihood. This finding may suggest that survivors in very serious situations were more successful at remaining out of the violent partnership – that these respondents were able to permanently extricate themselves from gravely serious partnerships where there was a serious threat of devastating injury. Finally, the odds of being at a greater probability of a TBI increased among respondents who sought help. One limitation of this study is its lack of generalizability. While these results should help to

inform future research on IPV related TBI, these findings are not generalizable. In other words, these results apply only to the survey participants who took part in this research.

This study is limited in that it is a cross-sectional, retrospective design which employed a convenience sample. This paper offered a descriptive exploration of characteristics associated with likely IPV-related TBI history among a sample of IPV survivors. The ultimate contribution of this research is to a) demonstrate the use of assessing likely TBI risk using the HELPS tool and b) the results of this research call special attention to help-seeking among survivors of IPV, which may signal a degree of seriousness that should warrant basic screening for TBI.

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