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The Effect of Intimate Partner Violence and Probable Traumatic Brain Injury on Mental Health Outcomes for Black Women

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Abstract

Severe intimate partner violence (IPV) including loss of consciousness from head injuries and/or strangulation can result in traumatic brain injury (TBI), a brain pathology characterized by altered brain function, cognitive impairment, and mental health disorders, including depression and posttraumatic stress disorder (PTSD). This study examines the prevalence of probable TBI (defined as loss of consciousness from a blow to the head and/or strangulation) and its association with comorbid PTSD and depression among Black women, who experience both higher rates of IPV and greater mental health burden than White and Latina women. Data come from a

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retrospective cohort study of 95 Black women with abuse history including IPV, forced sex, and childhood maltreatment. About one-third of women (n=32) had probable TBI. Among them, 38% (n=12) were hit on the head, 38% (n=12) were strangled to unconsciousness, and 25% (n=8) were strangled and hit on the head. Women with IPV history and probable TBI had significantly greater odds of various physical injuries including those that required medical care compared to other abused women. Probable TBI significantly increased comorbid PTSD and depression by 8.93 points (*SE=3.40*), after controlling for past violence ($F_{(4, 90)}$=3.67, *p<.01*). Findings from this study reinforce the need to screen women who lost unconsciousness due to IPV for TBI and facilitate referrals to IPV interventions and mental health treatment.

Keywords

intimate partner violence; domestic violence; physical abuse; sexual abuse; depression; posttraumatic stress disorder; strangulation; unconscious

Intimate partner violence (IPV), the physical and/or sexual violence, stalking, and/or psychological aggression inflicted by a current or former intimate partner (Breiding, Basile, Smith, Black & Mahendra, 2015), is a pervasive public health concern. IPV can lead to long-lasting physical and mental health consequences. Physical IPV, the use of intentional physical force, can result in injuries, disability, and even death (Breiding et al., 2015). In fact, physical IPV is a leading cause of death for women under age 44 (Campbell, Webster, and Glass, 2009; [Centers for Disease Control and Prevention CDC, 2018]; Petrosky et al., 2017). Nearly 1 in 4 women in the United States (US) experience physical IPV at some point in their lifetime. Black women experience higher rates of physical IPV and intimate partner homicide compared to White and Latina women (Black et al., 2011; Smith et al., 2018), and therefore, experience greater mental health burden from violence (Stockman, Hayashi, & Campbell, 2015).

Physical IPV that results in the loss of consciousness from head injuries and/or non-fatal strangulation can cause neurological changes indicative of traumatic brain injury (TBI)—a brain pathology characterized by an alteration in brain function, cognitive impairment, and mental health disorders. Symptoms of TBI can include neurologic deficits, loss of consciousness, decreased level of consciousness, changes in mental state, and/or memory loss (CDC, 2016; Langlois, Rutland-Brown, & Wald, 2006). In the last decade, TBI rates have increased to nearly 2.5 million, due in part, to public recognition in athletic and military populations, as well as improved TBI screening methods (National Center for Injury Prevention and Control [NCIPC], 2003; Pervez, 2018). However, the literature on the contribution of IPV to TBI is scant. The prevalence of TBI in women with histories of abuse by an intimate partner is likely substantial, but needs further exploration (Valera & Kucyi, 2017). Despite the dearth in the literature, one study of 537 abused Black women sampled from health care sites found that 49% experienced symptoms consistent with TBI (i.e., probable TBI) from head injuries and/or strangulation due to physical IPV (Campbell et al, 2018).

What is Traumatic Brain Injury?

TBI is a disruption of the brain's normal functioning after a blunt or penetrating head injury (Savitsky, Givon, Rozenfeld, Radomislensky, & Peleg, 2016). Asphyxia by strangulation ("choking")—external pressure to the neck that closes off blood vessels and/or air passages, depriving the brain of oxygen (cerebral hypoxia)—is another trauma that can result in TBI (Sauvageau & Boghossian, 2010). Even mild oxygen deprivation, with no loss of consciousness can result in mild TBI (Murray, Lundgren, Olson, & Hunnicutt, 2016). Seizures, coma, and brain death may occur in prolonged hypoxia (National Institute of Neurological Disorders and Stroke [NINDS], 2018). Multiple head injuries sustained throughout childhood, adolescence, and young adulthood have a cumulative effect and can increase vulnerability to chronic traumatic encephalopathy (CTE), a progressive neurodegenerative brain disorder from repetitive TBIs (Laurer et al., 2001; Stern et al., 2011; McKee et al., 2009).

TBI is formally diagnosed via a brain scan (i.e., MRI, CAT scan, PET scan), but neuropsychological testing (i.e., Glasgow Coma Scale) can suggest probable TBI and help clarify the extent of neurocognitive damage (Chung & Khan, 2013; Rimel, Jane, & Edlich, 1979; Teasdale & Jannett, 1974). Gender disparity in diagnosis and recovery of TBI means that women (and their providers) may be less aware of TBI risks, symptoms, and effects (Banks, 2007). For instance, the frequency and severity of reported TBI symptomatology (e.g., higher rates of abnormal CT results, headaches, dizziness, memory problems, difficulty concentrating, etc. relative to men) differ between men and women (Alston, Jones, & Curtin, 2012; Colantonio, Harris, Ratcliff, Chase, & Ellis, 2010; Munivenkatappa et al, 2016). One study suggested that women had twice the concussion rate (a type of mild TBI) as men. Furthermore, women's TBI severity was greater than men's, as demonstrated by their higher three-month post-concussion injury scores (Laskowski, Creed, & Raghupathi, 2015). In another study, women also experienced higher mortality rates from brain injuries than did men (Munivenkatappa, Agrawal, Shukla, Kumaraswamy, & Devi, 2016).

Traumatic Brain Injury as a Result of Intimate Partner Violence

Physical IPV, particularly in instances where the head and/or the neck are being hit, kicked, or slammed against something hard ("coup-contrecoup injuries"), or hypoxic/anoxic injury from strangulation, can cause TBI (Drew & Drew, 2004). Studies find that between 40% and 92% of IPV victims have sustained head injuries and nearly half have been strangled (Kwako et al., 2011; St. Ivany, Schminket, 2016). One study indicated that as much as 50% of IPV victims (N=890) who have been hit on the head and/or strangled are believed to have TBI ("probable TBI") (Campbell et al., 2017). Since TBI is commonly underdiagnosed among women seeking medical treatment for IPV-related injuries, women may be unaware that they have (or had) a TBI, and clinicians may not adequately treat those patients (CDC, 2015; Banks, 2007). Furthermore, since choking is a consensual, erotic fetish for some individuals, its significance can be downplayed—even among women with abuse histories (Khan, 2016; Rehor, 2015). Nevertheless, non-fatal strangulation from an intimate partner is associated with a 7.5-fold increase in homicide risk (Zilkens et al., 2016).

IPV victims who experienced multiple head and/or neck injuries can suffer repetitive TBIs, placing them at higher risk for long-term injury (Strack et al., 2018). For instance, Smith et al. (2001) found that women with IPV history, sustaining between two and five non-fatal strangulation events have significantly more memory loss and tinnitus (ringing in the ear) than women strangled only once. Additionally, women who were strangled more than five times reported more frequent muscle spasms, tinnitus, dizziness, and weakness on one side of the body. This is a significant point as IPV victims rarely suffer one physically violent event. A systematic review of brain injuries among IPV victims showed that between 23 to 72% of victims have been hit on the head or strangled five or more times (Kwako et al., 2011). Furthermore, sustaining subsequent head injuries before full resolution of an index TBI—referred to as “second impact syndrome”—may increase negative health effects, including cerebral vascular congestion, intracranial pressure, and cerebral edema. Second impact syndrome is associated with prolonged symptoms and poor neurorecovery; severe cases result in CTE or death (Laskowski et al., 2015).

Mental Health Effects of IPV and TBI

Evidence suggests that abused women are more likely to experience TBI than men (Smith et al., 2018) and with potentially more serious health consequences (Patch, Anderson & Campbell, 2017). Both IPV and TBI can result in significant acute and long-term mental health consequences. The mental health effects of IPV and TBI manifest in similar symptoms, making it difficult to differentiate between the two issues. For instance, people with IPV history and those with TBI both experience disruptions in cognitive functioning, mood, emotions, and sleep (Archiniegas, Anderson, Topkoff & McAllister, 2005; Murray et al., 2016). IPV victims who survive severe physical violence—whether significant brain injury occurred or not— frequently report difficulty concentrating, anxiety, depression, (Campbell, 2002) and/or nightmares and hypervigilance associated with PTSD (Woods et al., 2008); these symptoms are also common effects of TBI (Murray et al., 2016). Even symptoms of mild TBI, which includes memory loss, decreased motor coordination, difficulty maintaining attention, and poor judgement (Silver, McAllister & Arciniegas, 2009) are similar to what is observed from IPV (Campbell, 2002). Thus, findings once attributed solely to IPV-related mental health disorders may in fact reflect brain injury (Kwako et al., 2011), particularly with cumulative head and/or strangulation injuries, which is common among victims of violence (Sabri et al., 2016). Evidence shows that repeated head trauma, such as head injuries sustained in childhood or adulthood have a cumulative effect (Guskiewicz et al., 2003; Kwako et al., 2011); this can further hinder efforts to isolate the cause of TBI-related mental health conditions. For instance, female veterans with IPV-related TBI reported higher levels of comorbid PTSD and depression symptoms than female veterans with an IPV-related head injury event but no TBI and female veterans with no IPV-related head injury event (Iverson & Pogoda, 2015).

Purpose of the Study

This study examines the relationship between IPV, injuries associated with probable TBI (i.e., becoming unconscious from being hit on the head and/or strangulation), and their effect on mental health disorders (i.e., comorbid depression and PTSD) among abused Black

women. We focus on Black women because they have higher rates of physical IPV (Black et al., 2011) and the greater mental health burden (Stockman et al., 2015). The first aim is to describe the prevalence of probable TBI among abused Black women. The second aim is to examine the relationship between past experiences of violence and probable TBI. Finally, the third aim is to assess the effect of past violence and probable TBI on mental health disorders (i.e. comorbid depression and PTSD). Understanding the association between IPV, TBI, and their effect on mental health is critical in ensuring appropriate assessment, treatment/rehabilitation, and safety planning for abuse victims (Ackerman & Banks, 2003).

Methods

In the present study, the authors analyzed data on 116 Black women from The ESSENCE Project (R01HD077891), a retrospective cohort study examining the association between features of the built and social environment (e.g., neighborhood disorder, crime, poverty, racism, etc.), sexual assault, and HIV risk factors among Black women in Baltimore, Maryland. Cohorts were comprised of abused and non-abused women, however the current data includes abused women only. Data were collected from November 2016 to May 2018. The study design and procedures were approved by the institutional review boards of Johns Hopkins University and the University of California, San Diego.

Procedure

Black women recruited from two Baltimore City public health STD clinic were asked to participate in The ESSENCE Project. After providing informed consent, participants were screened for eligibility. To be eligible, participants had to self-report being biologically female, between ages 18–44, Black or African American, having sex with a man in the past 6 months, and having had at least two sexual partners in the past year or a high HIV risk sexual partner (i.e., used injection/non-injection drugs, has sex with men, been to prison, concurrent sex partner, had an STD, or was HIV-positive). Eligible women completed a 60 to 90-minute survey collected via audio computer-assisted self-interview. Participants received $35 ($10 for screening, $25 for survey), a transportation pass, and list of local community resources.

Measures

Probable TBI.—The primary independent variable was probable TBI, which we defined probable TBI as either or both of the following two criterions: (1) becoming unconscious from a blow to the head, and/or (2) becoming unconscious from being choked (i.e., strangulation). The first criterion was measured using the single item above on the revised Conflict Tactics Scale-2 (CTS-2; Straus, Hambly, Boney-McCoy & Sugarman, 1996). The second criterion was measured from an item on the study's screening survey (i.e., has your partner ever choked you until you became unconscious). Affirmative responses were classified as probable TBI (yes = 1; no = 0).

Past experiences of violence.—The control variables included past experiences of violence, which scored individually, since it was identified in the literature as independently associated with mental health disorders (Chapmen et al., 2004; Glover et al., 2010; Suliman,

et al., 2009) and we sought to isolate past violence from TBI-related mental health effects. Past violence included: (1) childhood maltreatment, (2) types of lifetime IPV, and (3) history of non-intimate partner forced sex. Childhood maltreatment was measured with two items from the screening survey: (1) “As a child, did anyone physically abuse you (by physical abuse, we mean slapping, beating, kicking, choking, or threats with weapons)?” and (2) “As a child, did anyone sexually abuse you (by sexual abuse, we mean forcing or pressuring for sex or physically hurting the sexual parts of your body, including touching that made you uncomfortable)?”. Categories of childhood maltreatment included: (0) no childhood abuse, (1) childhood physical abuse only, (2) childhood sexual abuse only, and (3) both childhood physical and sexual abuse. Types of lifetime IPV was a summation of yes responses to any item in subscales of the CTS-2: (a) psychological aggression, (b) physical assault, and (c) injury from a partner (sexual violence was not included in the analysis because all participants were exposed to forced sex). Individual CTS-2 items, as well as categories of lifetime IPV (listed above), and a summation of types of lifetime IPV (range: 0 to 3) were analyzed. History of non-intimate partner forced sex was a dichotomous variable defined as someone who was not a current or former intimate partner ever using force (i.e., hitting, holding down, or using a weapon) or threats of force to make you have sex.

Mental health.

The primary dependent variable was mental health, specifically comorbid depression and PTSD. Depressive symptoms in the past week was measured using the 4-point, 10-item Center for Epidemiologic Studies Short Depression scale (CESD-10) (Andresen, Malmgren et al., 1994). Example items included, “feeling lonely,” “could not get going,” and “sleep was restless”. CESD-10 showed internal consistency in this sample (α=.88). PTSD symptoms in the past month was measured using the 4-point, 9-item National Stressful Events Survey PTSD Short Scale (NSESSS) (LeBeau, Mischel et al. 2014). Items included having a very negative emotional state and being super alert, on guard, or constantly on the lookout for danger. Items were summed (range: 0–36) and showed internal consistency in this sample (α=.91). The CESD-10 and NSESS were scored individually and then summed to create a composite variable representing comorbid PTSD and depression (range: 0–66).

Analysis

First, skewness and kurtosis tests of normality were conducted. Second, descriptive statistics were generated to compare sociodemographic characteristics of the sample using the dichotomized probable TBI measure. Third, bivariate associations between probable TBI and lifetime IPV types were assessed with Pearson’s chi-square tests for categorical variables and independent t-tests for continuous variables. Finally, a multiple linear regression was conducted to ascertain the independent effect of probable TBI on PTSD and depression (individually and comorbid), adjusting for past violence (i.e., lifetime history of non-intimate partner forced sex, types of lifetime IPV, and childhood maltreatment). Of 116 study participants, 18% (n=21) abstained from responding to some or all of the CTS-2 items or responded with “I don’t know.” These participants were subsequently excluded from the final regression analyses, resulting in a final sample size of 95. All statistical analyses were conducted using Stata (Version 15.1).

Results

Sample Description

Table 1 reports the sample demographics. The mean age among the 95 study participants was 28.8 (SD 7.34). Approximately 22% (n=21) of the sample did not complete high school, 30.5% (n=29) had a high school degree or GED equivalent, 25.3% (n=24) had some college or trade/vocational training, and 22.1% (n=21) completed college or graduate school. The majority of participants (64.2%, n=61) earned an annual income of less than $10,000. Half of the sample (50.5%, n=48) were currently employed. The majority of the sample (73.7%, n=70), reported receiving public assistance (e.g., housing, Medicaid, WIC, food stamps, and disability assistance, etc.). Approximately half of the sample (51.6%, n=49) had children. There were no significant demographic differences between women with abuse history with and without probable TBI except for the number of women who had children (χ^2=11.5, $p<0.05$).

Aim 1: Prevalence of Probable TBI Among Black Women with Abuse History

Of the 95 women, 33.7% (n=32) were identified as having probable TBI, of which 37.5% (n=12) were hit on the head, 37.5% (n=12) were strangled to unconsciousness, and 25.0% (n=8) were strangled and hit on the head in the past year (results not shown). Figure 1 shows the overlap between these categories. Of the 32 women who were identified as having probable TBI, 28.1% (n=9) lost consciousness multiple times, and thus may have sustained multiple TBIs.

Aim 2: The Relationship Between Past Experiences of Violence and Probable TBI

Table 2 reports the relationship between past experiences of violence and probable TBI. About three in four women (77.9%, n=74) experienced at least one form of childhood maltreatment (i.e., physical abuse, sexual abuse, or both). Among those women, 19.0% (n=18) reported physical abuse only, 17.9% (n=17) reported sexual abuse only, and 41.1% (n=39) reported both physical and sexual child maltreatment. Pearson's chi-square test of association indicated that childhood maltreatment was significantly associated with probable TBI (χ^2=10.4, $p<.05$). Just over half of the sample (55.8%, n=53) experienced non-partner forced sex. There was no significant association between probable TBI and non-partner forced sex experience. All participants experienced some form of lifetime IPV with psychological abuse being most prevalent, followed by physical IPV, and injury. Pearson's chi-square test of association revealed that types of lifetime IPV was significantly associated with probable TBI (χ^2=18.7, $p<.001$).

Although all 95 participants were abused by an intimate partner, women classified as having probable TBI had significantly greater odds of experiencing psychological IPV (OR=3.57, 95% CI: 0.90–20.4, $p<0.05$), physical IPV (OR=3.45, 95% CI: 1.21–10.8, $p<0.05$), and receiving an injury from an intimate partner (OR=6.66, 95% CI: 2.29–20.8, p $<.001$).

Aim 3: The Effect of Past Violence and TBI on Mental Health Outcomes

The average depression score among the entire sample was 13.5 (SD=7.06). The CESD-10 cut off score of > or = 10 indicates significant depressive symptoms (Andresen, Malmgren et

al., 1994). Women identified as having probable TBI had depression scores 2.65 points higher than women without probable TBI (average score of 15.3 (*SD*=7.09) vs. 12.6 (*SD*=6.95), respectively), though this difference was not statistically significant. PTSD scores among the entire sample was 19.5 (*SD*=10.1). The NSESSS cut off score of > or = 24 indicates significant PTSD symptoms (LeBeau, Mischel et al. 2014). Women identified as having probable TBI scored an average of 7.76 points higher on the PTSD scale that women without probable TBI (average score of 24.8 (*SD*=8.08) vs. 16.9 (*SD*=9.95), respectively), which was statistically significant (95% CI: −11.7– −4.17, *p<.001*). Comorbid depression and PTSD in the entire sample was 33.1 (*SD*=15.1). Women identified as having a probable TBI had an average of 10.6 points higher compared to women without probable TBI (average comorbid score of 40.1 (*SD*=13.3) vs. 29.5 (*SD*=14.8), respectively), which was statistically significant (95% CI: −16.6–4.61, *p<0.001*).

Table 3 shows the multivariate regression results. In the unadjusted regression model (1a) for depression only ($F_{(1, 93)}$=3.04, *p<.10)*, probable TBI increased the CESD depression score by 2.64 (*SE=1.52, p<0.10)*. In the adjusted model (1b) that controlled for past violence, TBI was not significantly associated with depression symptomatology. With regard to PTSD only, in the unadjusted regression model (2a) ($F_{(1, 93)}$=15.3, *p<.001)* showed that probable TBI increased PTSD symptoms by 7.96 (*SE=2.03, p<0.001)*. In the adjusted model for PTSD only (2b) controlling for past experiences of violence ($F_{(4, 90)}$=4.51, *p<.005)*, TBI was independently associated with an increase in number of PTSD symptoms by 7.16 (*SE=2.23, p<0.005*).

Finally, in the unadjusted model (3a) for comorbid PTSD and depression ($F_{(1, 93)}$=11.7, *p<.005*), probable TBI increased comorbid PTSD and depression by 10.6 (*SE=3.11, p<.005)*. In the adjusted model ($F_{(4, 90)}$=3.67, *p<.01*) (3b) that controlled for past violence, probable TBI independently increased the cumulative number of symptoms by 8.93 (*SE=3.40, p<.05*).

Discussion

The present study estimated the prevalence of probable TBI among a sample of Black women with abuse history from community health clinics (i.e., not from domestic violence service organizations nor women who had sought help from the police department), and investigated the associations between probable TBI, past IPV experience, and comorbid PTSD and depression. We found three key results that carry public health implications for TBI screening among women with histories of abuse.

First, TBI from physical IPV was prevalent with about one-third of the sample (33.7%) sustaining injuries associated with probable TBI. This is a comparable, or somewhat smaller proportion, than that found in the scant literature on IPV-related TBI from both head injuries and strangulation. One study, which used a convenience sample of 99 women with severe IPV, found that about 75% of the women experienced at least one TBI and 50% had experienced multiple TBIs (Valera & Berenbaum, 2003). Another study using less stringent criteria for TBI than the present study (i.e., injuries to head and face &/or strangulation but not necessarily to unconsciousness) found a 50% prevalence among 537 African American women with abuse histories, sampled from primary health care settings, with 7% reporting a

head injury with loss of consciousness, 31% reporting any head injury, and 36% reporting strangulation but not necessarily with unconsciousness, and the overlap of the prior two categories not reported (Campbell et al, 2018). Iverson and Pagoda (2015) surveyed 179 female veterans and found 19% reported experiencing one or more acts of physical IPV to the head, neck or face that resulted in loss of consciousness, alternations in consciousness, posttraumatic amnesia, concussion or head injury (IPV-related strangulation was not assessed). The high prevalence of IPV-related probable TBI is alarming and calls for changes in the healthcare system to improve screening for TBI among girls and women with histories of abuse (Ackerman & Banks, 2003).

Non-fatal strangulation, the most common mechanism of probable TBI in the present sample, was particularly alarming given strangulation is associated with a 6-fold increased odds of experiencing attempted homicide and a 7-fold increased odds of homicide compared to women with abuse histories who have never been strangled (Glass et al, 2008). This finding carries strong implications for the need to screen for strangulation among women in abusive relationships to better understand the prevalence of TBI and to intervene in order to prevent intimate partner homicide. TBI among women with histories of abuse often underdiagnosed or overlooked (Banks, 2007). Enhanced screening for TBI-related symptoms may improve our understanding of the prevalence and health repercussions for TBI among women with histories of abuse (Hux, Schneider & Bennett, 2009), and prevent future incidents of violence or lethality.

Second, women classified as experiencing probable TBI also experienced more overall violence than women with histories of abuse without probable TBI. Physical, sexual, and psychological IPV were significantly and strongly associated with probable TBI. This finding supports the literature that states women who have repetitive head injury could have increased vulnerability to TBI. Additionally, women with probable TBI experienced physical violence in which they reported injuries that require medical attention, presenting an important opportunity for screening and intervention from medical care providers. Further, significant associations were found between probable TBI and forced sex and childhood maltreatment (i.e., physical abuse, sexual abuse, or both). This is particularly important, as it is common for women with experiences of IPV to have histories of childhood maltreatment (Chapmen et al., 2004; Glover et al., 2010; Suliman, et al., 2009) and there is a strong likelihood that those women have experienced previous TBIs as girls and young women. Cumulative TBI has been linked to more severe and long-lasting TBI symptoms (Guskiewicz et al., 2003), therefore, may increase risk and severity of PTSD and depression.

Lastly, probable TBI was associated with increased psychological abuse and independently increased comorbid PTSD and depression symptoms, even after controlling for past violence. Strangulation is a physical abuse tactic, but has implicit psychological effects signaling that the abuser has the capacity to take the victims life (Training Institute for Strangulation Prevention, 2017). Future prospective studies are needed to tease out the mental health sequelae of IPV and TBI, as the effects often overlap (Kwako et al., 2011).

Implications for Practice

Results reinforce the critical need for healthcare professionals to assess women for IPV, to inquire about recent and/or past injuries resulting in unconsciousness (i.e., strangulation, hit on the head), and to screen women with histories of IPV for TBI-related neurological disorders and facilitate linkage to mental health treatment. Among the 28.1% (n=9) of women who reported lost consciousness multiple times is concerning, as this underscores the need for healthcare systems to prudently assess for IPV, as well as screen quickly for TBI among women with histories of IPV (e.g. using the screen for DV related TBI developed by the VA (Iverson et. Al, 2017) in order to ensure the women receive the psychological and neurological referrals needed that will assess for cognitive function alterations. If there has been recent TBI, either from head injury and/or strangulation, emergency care is immediately needed (see emergency protocols at www.strangulationinstitute.org). Referring and providing interventions that specifically address historical or recent IPV would be beneficial to the women, as such programs have been show to improve women's mental health sequelae. Specifically, self-care engagement and self-efficacy have been identified as internal resources for managing abusive relationships (Sabri et al., 2016).

Limitations

There are limitations to this study. First, the study is retrospective, therefore we cannot ascertain whether the mental health outcomes observed were due to the physical IPV injuries, probable TBI, or some other confounding effect. Second, the parent study's eligibility criteria sought to examine Black women at risk for HIV who experienced forced sex (i.e., multiple male sex partners and/or partners with multiple HIV risk behaviors); thus, the sample is not representative of all abused women, nor all Black women. Another limitation relates to the variability in accepted definitions and diagnosis of TBI. The present study classified women who were hit on the head and/or strangled to unconsciousness as experiencing probable TBI; however, some definitions of TBI (Crowe et al., 2018; Leo & McCrea, 2016; Savitsky, Givon, Rozenfeld, Radomislensky, & Peleg, 2016) define is as a result of head injuries only. Relatedly, this study relied on self-reported IPV and loss of consciousness, which are subject to recall bias. Relatedly, we measured depression in the past week, PTSD in the past month, and controlled for lifetime PTSD, which may have introduced error and are subject to recall bias. Finally, we were only able to infer probable TBI, and did not specifically screen for nor test for TBI. While assessments such as the Glasgow Coma Scale (Teasdale & Jennett, 1974) are available, brain scans ante- and post-mortem are the most definitive (Panzer, Covaliav, Augat, & Peschel, 2017) diagnostic methods, and were not feasible in the present study. Additionally, we did not measure neurological symptoms associated with TBI. Despite these limitations, the results are compelling and call for further studies examining the prevalence of IPV and TBI to further understand this phenomenon.

Conclusion

In conclusion, the present study demonstrated that a significant proportion of abused Black women who sustained probable TBI injuries had a greater likelihood of experiencing

comorbid PTSD and depression. These findings reinforce the critical need for healthcare professionals to assess for IPV, screen for TBI-related neurological disorders and injuries including recent and/or past unconsciousness, and facilitate linkage to IPV interventions and mental health treatment.

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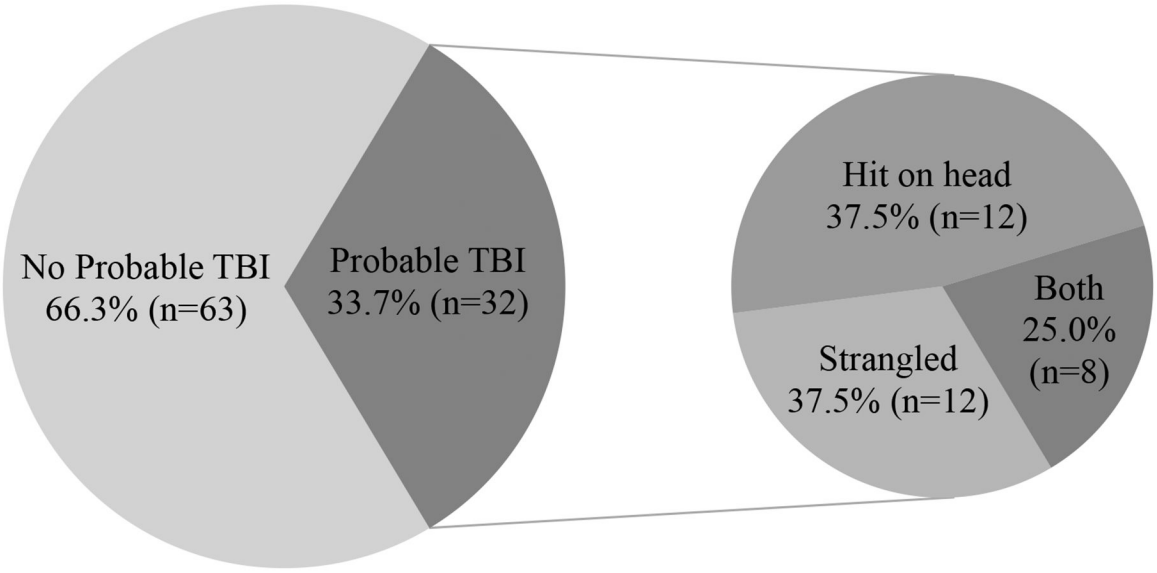

Figure 1.
Proportion of Patterns of Violence Resulting in Probable TBI Among Black Women

Table 1

Demographic Characteristics of Black Women with Abuse History (N=95)

Characteristic	Total Sample (N=95)	Women with no TBI (n=63)	Women with Probable TBI (n=32)	X^2
	N(%)	n(%)	n(%)	
Age				5.56
< 20	8(8.42)	0(0)	8(8.42)	
20–29	50(52.6)	33(34.7)	17(17.9)	
30–39	25(26.3)	16(16.8)	9(9.47)	
40–49	12(12.6)	6(6.32)	6(6.32)	
Race				9.54
Black or African-American	85(89.5)	58(61.1)	27(28.4)	
Black or African-Caribbean	4(4.21)	4(4.21)	2(2.11)	
Black or African Born	3(3.16)	1(1.05)	2(2.11)	
Mixed	2(2.11)	0(0)	2(2.11)	
Other	1(1.05)	0(0)	1(1.05)	
Education				4.82
> 9th grade, did not complete high school	21(22.1)	13(13.7)	8(8.42)	
High school grad or GED	29(30.5)	22(23.2)	7(7.37)	
Some trade/vocational school or college	24(25.3)	13(13.7)	11(11.6)	
Completed college, trade/ vocational, or graduate school	21(22.1)	15(15.8)	6(6.32)	
Income ($)				2.31
Less than 10,000	61(64.2)	23(24.2)	38(40.0)	
Between 10,000 – 19,000	17(17.9)	5(5.26)	12(12.6)	
Between 20,000 – 29,000	11(11.6)	3(3.16)	8(8.42)	
30,000 or more	6(6.32)	1(1.05)	5(5.26)	
Number of Children				11.5 *
No children	46(48.4)	34(54.0)	12(12.6)	
1	20(21.11)	16(16.8)	4(4.21)	
2	15(15.8)	5(5.26)	10(10.5)	
3 or more	14(14.7)	8(8.42)	6(6.32)	
Currently Employed	47(49.5)	34(35.8)	13(13.7)	1.51
Receiving Assistance [1]	70(73.7)	44(46.3)	26(27.4)	1.42

[1] Refers to assistance such as housing, Medicaid, WIC, food stamps, and disability assistance.

* *Note:* p<.05

Table 2

Past Violence between Black Women with and without Probable TBI (N=95)

Characteristic	Total Sample (N=95)	Women without TBI (n=63)	Women with Probable TBI (n=32)	X^2
	N(%)	n(%)	n(%)	
Childhood Abuse				10.4*
No childhood maltreatment	21(22.1)	16(25.4)	5(15.6)	
Childhood physical abuse only	18(18.9)	10(15.9)	8(25.0)	
Childhood sexual abuse only	17(17.9)	16(25.4)	1(3.12)	
Both childhood physical and sexual abuse	39(41.1)	21(33.3)	18(56.3)	
Types of Lifetime IPV	-	-	-	18.7***
Psychological IPV	75(78.9)	46(73.0)	29(90.6)	
Physical IPV	57(60)	32(50.8)	25(78.1)	
Injury from partner	47(49.5)	22(34.9)	25(78.1)	
Non-partner forced sex	**53(55.8)**	**31(49.2)**	**22(68.8)**	3.29**

* *Note:* p<.05;

** p<.01;

*** p<.001

Table 3

Multivariate Regression Model Examining Effect of Past Violence and TBI on Mental Health Outcomes (N=95)

Model	β	SE	95% CI	*p*
1a: Depression only				
Probable TBI	2.64	1.52	−0.37–5.66	0.09
Past IPV	1.16	0.62	−0.06–2.39	0.06
Childhood maltreatment	0.52	0.61	−0.68–1.72	0.39
Non-partner forced sex	0.52	1.47	−2.40–3.43	0.73
1b: Depression only, adjusted for past violence				
Probable TBI	1.77	1.67	−1.54–5.08	0.29
Past IPV	0.87	0.67	−0.46–2.20	0.20
Childhood maltreatment	0.35	0.62	−0.89–1.59	0.57
Non-partner forced sex	−0.05	1.78	−3.06–2.97	0.98
2a: PTSD only				
Probable TBI	7.96	2.03	3.92–12.0	0.000
Past IPV	2.16	0.87	0.44–3.88	0.014
Childhood maltreatment	0.92	0.86	−0.79–2.63	0.29
Non-partner forced sex	−0.10	2.09	−4.25–4.04	0.96
2b: PTSD only, adjusted for past violence				
Probable TBI	7.16	2.23	2.73–11.6	0.002
Past IPV	1.07	0.89	−0.71–2.84	0.24
Childhood maltreatment	0.63	0.83	−1.03–2.28	0.45
Non-partner forced sex	−1.79	2.03	−5.82–2.23	0.38
3a: Comorbid PTSD and depression				
Probable TBI	10.6	3.11	4.43–16.8	0.001
Past IPV	3.33	1.30	0.75–5.90	0.012
Childhood maltreatment	1.44	1.29	−1.12–4.00	0.27
Non-partner forced sex	0.41	3.14	−5.81–6.64	0.90
3b: Comorbid PTSD and depression, adjusted for past violence				
Probable TBI	8.93	3.40	2.18–15.7	0.010
Past IPV	1.94	1.36	−0.77–4.64	0.16
Childhood maltreatment	0.98	1.27	−1.54–3.51	0.44
Non-partner forced sex	−1.84	3.09	−7.98–4.31	0.55

Note: SE = Standard error; CI = Confidence Interval; past violence includes lifetime history of non-intimate partner forced sex, types of lifetime IPV, and childhood maltreatment