Published in final edited form as:

J Interpers Violence. 2017 August ; 32(16): 2471–2495. doi:10.1177/0886260515592651.

Sleep Disturbance Partially Mediates the Relationship Between Intimate Partner Violence and Physical/Mental Health in Women and Men

Linden Lalley-Chareczko, MA^{1,2}, Andrea Segal, MS¹, Michael L. Perlis, PhD¹, Sara Nowakowski, PhD³, Joshua Z. Tal, MS⁴, and Michael A. Grandner, PhD^{1,5}

¹University of Pennsylvania, Philadelphia, PA, USA

²Philadelphia FIGHT Community Health Centers, PA, USA

³University of Texas Medical Branch, Galveston, TX, USA

⁴Palo Alto University, CA, USA

⁵University of Arizona, Tucson, AZ, USA

Abstract

Intimate partner violence (IPV) is a worldwide health concern and an important risk factor for poor mental/physical health in both women and men. Little is known about whether IPV leads to sleep disturbance. However, sleep problems may be common in the context of IPV and may mediate relationships with mental/physical health. Data from the 2006 Behavioral Risk Factor Surveillance System (BRFSS) were used ($N = 34,975$). IPV was assessed in female and male participants for any history of being threatened by, physically hurt by, or forced to have sex with an intimate partner (THREAT, HURT, and SEX, respectively), and, further, as being forced to have sex with or physically injured by an intimate partner within the past year (SEXyr and HURTy, respectively). These survey items were coded yes/no. Sleep disturbance was assessed as difficulty falling asleep, staying asleep, or sleeping too much at least 6 of the last 14 days. Logistic regression analyses, adjusted for age, sex, race, income, education, and physical/mental health, assessed whether IPV predicted sleep disturbance. Sobel–Goodman tests assessed whether relationships between IPV and physical/mental health were partially mediated by sleep disturbance. All IPV variables were associated with sleep disturbance, even after adjusting for the effects of age, sex, race/ethnicity, income, education, employment, marital status, physical health and mental health. THREAT was associated with sleep disturbance (odds ratio [OR] = 2.798, $p < .0001$), as was HURT (OR = 2.683, $p < .0001$), SEX (OR = 3.237, $p < .0001$), SEXyr (OR = 7.741, $p < .0001$), and HURTy (OR = 7.497, $p < .0001$). In mediation analyses, all IPV variables were associated with mental health ($p < .0001$), and all were associated with physical health ($p < .007$) except SEXyr. Sleep disturbance partially mediated all relationships (Sobel $p < .0005$ for all tests).

Reprints and permissions: sagepub.com/journalsPermissions.nav

Corresponding Author: Michael A. Grandner, Center for Sleep and Circadian Neurobiology, University of Pennsylvania, 3624 Market Street, Suite 205, Philadelphia, PA 19104, USA. grandner@upenn.edu.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Mediation was around 30%, ranging from 18% (HURTy and mental health) to 41% (HURT and physical health). IPV was strongly associated with current sleep disturbance above the effect of demographics and overall mental/physical health, even if the IPV happened in the past. Furthermore, sleep disturbance partially mediates the relationship between IPV and mental/physical health. Sleep interventions may potentially mitigate negative effects of IPV.

Keywords

intimate partner violence; sleep; epidemiology; mental health; physical health

Introduction

A recent report from the National Center for Injury Prevention and Control states that 35.6% of women and 28.5% of men surveyed ($n = 16,507$) in the United States have experienced rape, physical violence, and/or stalking by an intimate partner in their lifetime (Black et al., 2011). Similar reports by the Bureau of Justice Statistics state that of households reporting violent crime, more than one third reported violent crimes committed inside the home (Truman & Smith, 2012). Furthermore, the Centers for Disease Control and Prevention (CDC) reports that, of the individuals who reported experiencing intimate partner violence (IPV), 3 in 10 women and 1 in 10 men reported at least one physical and/or mental health consequence because of their experience of IPV. Examples include reports of being fearful or concerned for safety, post-traumatic stress disorder (PTSD) symptoms, need for health care, injury, or contacting a crisis hotline (Black et al., 2011).

A sizable body research exists demonstrating the deleterious effects of IPV. Women who have experienced IPV report poorer overall health status and a greater number of physical symptoms (Dutton, Goodman, Lennig, & Murphy, 2004; Hurwitz, Gupta, Liu, Silverman, & Raj, 2006; Lown & Vega, 2001; Sutherland, Sullivan, & Bybee, 2001) as well as hospitalizations (Kernic, Wolf, & Holt, 2000). Specifically, victims of IPV report headaches, gastrointestinal difficulties, dizziness, fainting, hypertension, chest pain, smoking, and substance use (Campbell, 2002; Campbell & Lewandowski, 1997; Holt, Kernic, Lumley, Wolf, & Rivara, 2002; Kernic et al., 2000; McCauley, Kern, Kolodner, Derogatis, & Bass, 1998; Resnick, Acierno, & Kilpatrick, 1997). Smoking and substance use among those who experience IPV further perpetuate the cycle of health compromising behaviors, as they are associated with the development of various cancers and other chronic diseases (Gandini et al., 2008; Rehm et al., 2009; Wells, Golding, & Burnam, 1989). Bonomi, Anderson, Rivara, and Thompson (2007) found that women who experienced physical and/or sexual IPV had impaired health-related quality of life than women who had never experienced IPV. Similarly, Staggs and Riger (2005) found chronic IPV to be associated with poorer health and recent IPV to be associated with unstable employment. Staggs and Riger also report no mediation effect of health on employment, lending support to the idea of the experience of IPV being both physically and psychologically toxic.

The psychological impacts of IPV are also well-documented. Researchers have reported higher prevalence of depression, anxiety, substance abuse, suicidality, and PTSD among

women and men with a history of IPV (Campbell, 2002; Coker et al., 2002; Devries et al., 2013; Dutton et al., 2004; Ellsberg, Caldera, Herrera, Winkvist, & Kullgren, 1999; Gierisch et al., 2013; Golding, 1999; Hurwitz et al., 2006; Loeb et al., 2014; Tolman & Rosen, 2001; Woods, 2000; Zilberman & Blume, 2005). With increasing severity of the IPV comes higher PTSD symptom severity and levels of depression, demonstrating a direct link between IPV and common psychological symptomatology associated with IPV (Coker et al., 2002; Dutton et al., 2004; Woods, 2000). Ratner (1993) found anxiety, insomnia, and social dysfunction to be especially problematic for victims of IPV.

Sleep disturbances, in particular, may be a product of complex relationships among the physical, psychological, and environmental mechanisms in play for those who endure IPV, making sleep disturbance of particular concern. Sleep disturbance is common in the U.S. population and has been identified as a public health problem by the Institute of Medicine (Colten, Altevogt, & Institute of Medicine Committee on Sleep Medicine and Research, 2006). Previous research shows that the prevalence of general sleep disturbance is approximately 20% in the U.S. population (Grandner, Martin, et al., 2012). Several studies have explored the association between the experience of IPV and insomnia (Campbell, 2002; Campbell & Lewandowski, 1997; Golding, 1999; Hurwitz et al., 2006; Pigeon et al., 2011; Sutherland et al., 2001). Pigeon and colleagues (2011) found that 46% of participants with a history of IPV surveyed indicated clinically significant insomnia, with depressed women reporting more severe PTSD symptoms and a greater likelihood of having insomnia. After controlling for PTSD severity, the presence of insomnia was related to an eight-fold likelihood of also having depression. Hurwitz and colleagues (2006) qualitatively observed links between IPV-induced depression/anxiety and poor sleep in a group of U.S. South Asian women. Romans, Cohen, Forte, Du Mont, and Hyman (2008) demonstrated IPV within the past 5 years predicted increased insomnia, anxiety, depression, and psychotropic medication use in both men and women in a large Canadian sample, after controlling for covariates, such as physical health. Similarly, Matud (2005) found that low self-esteem associated with IPV to be the most relevant predictor of depression, anxiety, insomnia, and somatic symptoms in a group of Spanish women.

If the experience of IPV leads to sleep disturbance, this itself carries significant health consequences for both women and men. For example, short sleep duration and/or poor sleep quality have been associated with increased mortality (Grandner, Patel, Hale, & Moore, 2010; Kripke, Garfinkel, Wingard, Klauber, & Marler, 2002), cardiometabolic disease (Altman et al., 2012; Grandner, Jackson, Pak, & Gehrman, 2012), obesity (Watanabe, Kikuchi, Tanaka, & Takahashi, 2010), and increased inflammation (Grandner et al., 2013; Hayes, Xu, Babineau, & Patel, 2011; Patel et al., 2009). Given the potential for combined and interactive health effects, it is important to investigate the nature of the relationship between IPV and sleep disturbance.

In addition to the health implications, the study of sleep in the context of IPV presents a unique opportunity from a theoretical viewpoint. Most, if not all, theories about insomnia specifically state problems initiating and/or maintaining sleep are precipitated by biopsychosocial stressors (Buysse, Germain, Hall, Monk, & Nofzinger, 2011; Ellis, Gehrman, Espie, Riemann, & Perlis, 2012; Perlis, Giles, Mendelson, Bootzin, & Wyatt,

1997; Perlis, Shaw, Cano, & Espie, 2010). That is, actual or perceived threat is believed to be the main triggering factor for acute, if not chronic, insomnia. This being the case, it follows that IPV should be substantially related to the incidence and severity of insomnia. This is perhaps even more salient for IPV relative to other stressors and life events, as safety issues may be more acutely felt when one's home and sleep environment (i.e., the bed) represent past or present danger and when one's closest friends and family are (or were) the source of threat.

Despite the theoretical implications and potential health consequences, several aspects of this relationship remain unaddressed. Epidemiologic data on IPV related to sleep are scarce. In particular, previous research on women or men has not explored the role of sleep disturbance in the relationship between IPV and health. Accordingly, the present study hypothesized that IPV would be significantly correlated with the incidence of insomnia and that this association would be strongest with present versus past IPV. The present study examined epidemiologic data from the Behavioral Risk Factor Surveillance System (BRFSS) to assess (a) whether history of IPV was associated with current sleep disturbance and (b) whether sleep disturbance partially mediates the relationship between IPV and current health status.

Method

Data Source

Data from the 2006 BRFSS were used ($N = 34,975$). BRFSS is an ongoing, state-based system of health surveys collecting information on health risk behaviors related to chronic disease and injury. The BRFSS employs random-digit-dialing to survey male and female adults over 18 years of age, creating world's largest telephone survey designed to monitor health-related behaviors in the general population. Due to the state-based funding and design, not all states are administered all items. The present analyses include individuals from the states/territories that included assessment of sleep disturbance and also IPV (Alaska, Hawaii, Louisiana, Montana, Nevada, Virginia, West Virginia, and Virgin Islands). The response rate varied across included states, with a mean of 54.0%, median of 53.0%, and range of 47.0% (Louisiana) to 63.3% (Alaska). The completion rate (number of interviews completed relative to the number of interviews completed, terminated, and/or refused) also varied across states, with a mean and median of 78.6% and a range of 69.0% (Louisiana) to 85.0% (Alaska) (CDC, 2007).

To ensure the generalizability of the results and mitigate response biases, each participant was assigned a weight to be used for analysis. Because of the nature of the sampling scheme, the BRFSS sample is not fully representative of the general population. Therefore, all participant data are weighted so that biases in the sample do not create inaccurate results. The process of determining participants' weighting is discussed in more detail in the BRFSS documentation (CDC, 2007). To summarize, each weight is calculated using a combination of (a) a weight accounting for differences in the basic probability of selection among subsets of regions delineated by combinations of area code and telephone prefix, (b) a weight adjusting for non-coverage and non-response, (c) the number of residential telephone lines in the participant's home, and (d) the number of adults in the participant's household.

Measures

IPV—IPV was assessed as any history of being (a) threatened by an intimate partner (“Has an intimate partner EVER THREATENED you with physical violence? This includes threatening to hit, slap, push, kick, or hurt you in any way?”), (b) physically hurt by an intimate partner (“Has an intimate partner EVER hit, slapped, pushed, kicked, or hurt you in any way?”), or (c) forced to have sex with an intimate partner (“Have you EVER experienced any unwanted sex by a current or former intimate partner?”). Specifically examining the preceding 12 months, the BRFSS assessed whether respondents had been (d) forced to have sex with an intimate partner (“In the past 12 months, have you experienced any physical violence or had unwanted sex with an intimate partner?”) or (e) physically injured by an intimate partner (“In the past 12 months, have you had any physical injuries, such as bruises, cuts, scrapes, black eyes, vaginal or anal tears, or broken bones, as a result of this physical violence or unwanted sex?”). These survey items were coded yes/no and abbreviated as THREAT, HURT, SEX, HURTy, and SEXy, respectively.

Sleep disturbance—Sleep disturbance was assessed as difficulty falling asleep, staying asleep, or sleeping too much at least 6 of the last 14 days. Participants answered one question on sleep disturbance during the BRFSS survey: “Over the last 2 weeks, how many days have you had trouble falling asleep or staying asleep or sleeping too much?” Answers ranged from 0 to 14; however, the response distributions were bimodal, with peaks at 0 and 14. Sleep disturbance was therefore dichotomized into those who report complaints more than 6 days out of 14 and those who report complaints less than 6 days out of 14. This and similar approaches have been utilized previously (Grandner, Hale, et al., 2012; Grandner, Jackson, Pak, & Gehrman, 2012; Grandner, Jackson, Pigeon, Gooneratne, & Patel, 2012; Grandner, Martin, et al., 2012; Grandner, Patel, Gehrman, et al., 2010; Grandner et al., 2011).

Covariates—Covariates used to adjust for demographic and socioeconomic factors included age, sex, race/ethnicity (White, Black/African American, Hispanic/Latino, and Asian/other), education (less than high school, high school graduate, some college, college graduate), income level (<\$10,000 pre-tax income per year, \$10,000-15,000, \$15,000-20,000, \$20,000-25,000, \$25,000-35,000, \$35,000-50,000, \$50,000-75,000, >\$75,000), employment (employed, self-employed, retired, student, homemaker, unemployed <1 year, unemployed >1 year, unable to work), marital status (married, part of an unmarried couple, never married, divorced, separated, widowed), and day of poor physical/mental health. Previous analyses of these data found age, gender, education, employment, marital status, and income to be significant predictors of sleep disturbance in the present sample (Grandner, Patel, Gehrman, et al., 2010).

Statistical Analyses

Complete-case analysis was implemented; only participants who provided complete data were included for analysis. Preliminary analyses examined univariate comparisons for all outcome variables and covariates across levels of sleep disturbance using *t* tests for continuous variables and chi-square tests for categorical variables.

The researchers then conducted a series of logistic regression models for each of the five dichotomous outcomes of THREAT, HURT, SEX, HURTYr, and SEXyr. All sampling was weighted appropriately for representativeness, using weighting scores specifically developed for BRFSS 2006. The odds ratios (ORs) and 95% confidence intervals (CIs) were estimated among groups relative to a preselected reference. Two models were evaluated. First, an unadjusted model assessed gross associations between sleep disturbance and IPV variables. Second, an adjusted model examined associations adjusting for age, sex, race/ethnicity, income, education, employment, marital status, overall physical health, and overall mental health.

Finally, a test was employed to assess whether sleep disturbance partially mediates the association between IPV and mental and physical health. This approach was based on the original method of Baron and Kenny (1986). For the purpose of this analysis, the predictor/independent variable is IPV, the outcome/dependent variable is mental or physical health, and the mediator variable is sleep disturbance. This approach involved four tests of specific effects: (a) Path A: Association between the predictor/independent variable and the mediator variable; (b) Path B: Association between the mediator variable and the outcome/dependent variable in the presence of the predictor/independent variable; (c) Path C1: Association between the predictor/independent variable and the outcome/dependent variable; and (d) Path C2: Association between the predictor/independent variable and the outcome/dependent variable in the presence of Path B. For full mediation, Paths A, B, and C1 need to be significant, and Path C2 needs to be non-significant. If Path C2 remains significant, partial mediation is possible. In this case, the magnitude of the difference between C1 and C2 are evaluated to determine whether the mediator variable significantly reduced the magnitude of the effect (reflected in the proportion of mediation). This is formally evaluated using a Sobel test (Sobel, 1982, 1986), which produces a *Z* score for the proportion and *p* value.

Analyses were performed using STATA software Version 12 (StataCorp, College Station, Texas). All statistical tests were two-tailed. Statistical significance was set at the $p < .05$ level.

Results

Characteristics of the Sample

The present analyses included 34,975 individual responses to the 2006 BRFSS. Of those included in the present analyses, the mean age was 45.8 ($SD = 17.8$), the majority of participants identified themselves as White (69.3%), married (59.7%), and employed (52.3%). The majority of the subjects had at least some college education (58.7%) and earned at least \$50,000 a year (45.7%). Complete sociodemographic data are presented in Table 1. The present sample also reported 12.9% had been threatened by an intimate partner in their lifetime, 14.4% had been hurt by an intimate partner in their lifetime, 6.0% had been forced to have sex by an intimate partner in their lifetime, 0.8% has been hurt or forced to have sex in the preceding year, and 0.3% had been injured by an intimate partner in the last year.

Subjects who were included in analyses were compared with those who were not included in the analysis, to assess for systematic differences. Overall there were very few differences between groups, suggesting a lack of systematic bias. For example, similarities were found for mean age (45.5 excluded, 45.3 included), percent female (51% excluded, 51% included), percent college graduates (32% excluded, 33% included), percent earning >\$75,000 (27% excluded, 31% included), percent married (60% excluded, 62% included), percent employed (52% excluded, 54% included), mean number of days of poor physical health (3.6 excluded, 3.5 included), mean number of days of poor mental health (3.5 excluded, 3.5 included), and percent with sleep disturbance (19% excluded, 20% included). There was a noteworthy nominal difference in race/ethnicity with 66% of the excluded sample being non-Hispanic White, compared with 73% of the included sample being non-Hispanic White.

Regression Results

Results of binary logistic regression analyses are reported in Table 2. All IPV variables were associated with increased likelihood of sleep disturbance, in both unadjusted and adjusted analyses. Overall, in adjusted analyses, those who were ever threatened, ever forced to have sex, and ever hurt by an intimate partner were 2 to 3 times as likely to report current sleep disturbance at least 3 nights per week. Even stronger relationships were found for variables indicating recent events, with those reporting being hurt or injured or forced to have sex in the past year being 7 to 8 times as likely to report current sleep disturbance.

Interaction terms used to evaluate whether results differed by gender were significant for all IPV variables ($p < .0001$ for all). When results were stratified by gender, results were similar, with some relatively minor exceptions. These results are also depicted in Table 2. Relationships between sleep disturbance and lifetime events were slightly stronger for women and relationships with more recent events were stronger among men.

Interaction terms used to evaluate whether results differed by race/ethnicity were significant for all IPV variables ($p < .0001$ for all). Stratified analyses are presented in Table 3. When results were stratified by race/ethnicity, some patterns emerged. Compared with non-Hispanic Whites, relationships between sleep disturbances and recent IPV were less strong among Blacks/African Americans, much stronger among Asians/Others, and in the opposite direction among Hispanic/Latinos (such that IPV in the past year was associated with lower likelihood of sleep disturbance).

Relationship of IPV and Mental/Physical Health

Mediation analyses are reported in Table 4. For mental health, all paths were significant—IPV was associated with sleep disturbance, IPV was associated with mental health, and sleep disturbance was associated with mental health. Sleep disturbance did, however, partially mediate the relationship between IPV and mental health. The degree of mediation varied from 18.05% (injury in the past year) to 29.74% (ever hurt). For overall physical health, all relationships were significant for nearly all variables, such that IPV and sleep disturbance were both associated with physical health, and IPV was associated with sleep disturbance. The one exception was that being forced to have sex or being hurt in the past year was not associated with overall physical health. Therefore, this IPV variable was excluded from

mediation analyses. Of the remaining variables, sleep disturbances significantly mediated all relationships between IPV variables and physical health. The degree of mediation varied from 25.99% (injured in the past year) to 40.68% (ever hurt).

When these analyses were stratified by gender, clear differences emerged (see Table 4). For women, the results were approximately the same magnitude (or in many cases slightly stronger) as those for the complete sample. For men, however, sleep disturbances partially mediated the relationship between poor mental health and three of the IPV variables (ever threatened, ever hurt, and forced to have sex or hurt in the past year), but there was no partial mediation for the other variables.

Discussion

The present study sought to confirm the significant relationship between the experience of IPV and self-reported poor sleep in large sample ($N = 34,975$) of American women and men using data from the 2006 BRFSS. Furthermore, the present study aimed to demonstrate the effects of sleep disturbance on the relationship of IPV to physical and mental health problems. Specifically, it was hypothesized that the reported experience of sleep disturbance during the survey period would predict the self-report of IPV. It was further hypothesized that reported sleep disturbance partially mediates the association between IPV and mental and physical health.

In examining the descriptive results in Table 1, the hypotheses were generally supported, with the rates of IPV much higher (from 2-7 times higher) among those who report sleep disturbances. For example, approximately 12% of those who did not report sleep disturbances did report that they were ever hurt by a partner, but this was more than double (26%) among those with sleep disturbance. Also, although only about 0.2% of those without sleep disturbance reported that they were hurt in the past year, this rate was 7 times higher in those with sleep disturbance. Concurrently, rates of poor mental and physical health were more common among those with sleep disturbance. For example, those without sleep disturbance reported poor mental or physical health about 2.2 to 2.6 days per month, whereas this number was 7.8 to 9.0 days for those with sleep disturbances.

In accordance with study hypotheses, the results demonstrate women and men who reported being threatened, forced to have sex, or hurt in their lifetimes by an intimate partner were 2 to 3 times as likely to report current sleep disturbance 3 or more nights per week. More profound relationships were found for variables indicating recent experiences of IPV, with those reporting being hurt or injured or forced to have sex in the past year being 7 to 8 times as likely to report current sleep disturbance. This study supports the association of IPV and sleep disturbance shown in the few studies looking at these factors, especially in male victims of IPV (Hurwitz et al., 2006; Matud, 2005; Pigeon et al., 2011; Romans et al., 2008). Further analyses indicated sleep disturbance partially mediated a significant portion (18.05% [injury in the past year] —29.74% [ever hurt]) of the relationship between IPV and mental health. When examining physical health, only recent (<1 year) sexual or physical incidences of IPV was not significant; the impact of all other IPV variables on physical health, such as lifetime incidences of sexual, physical, and verbal abuse and recent (1< year) injury were

each independently mediated by poor sleep. The degree of mediation ranged from 25.99% for being injured in the past year to 40.68% for ever being hurt.

Results differed by gender, with significant interactions for all IPV variables. Although nominally similar, the pattern of results suggested that the relationships between sleep disturbance and lifetime prevalence of IPV variables were slightly stronger for women than men. Furthermore, nominally, the results between IPV events in the past year were more strongly associated with sleep disturbance among men. The relationship between sleep disturbance and IPV also depended on race/ethnicity. For example, there was a significant association between sleep disturbance and ever having been threatened by an intimate partner in all groups except Hispanics/Latinos. Also, associations between IPV in the past year (forced to have sex or physically hurt) were associated with sleep disturbance in non-Hispanic Whites and Asians/Others, but not Blacks/African Americans and, paradoxically, IPV in the past year was associated with decreased likelihood of sleep disturbance among Hispanics/Latinos. Interpretations of these results should be cautions, though, since these events were relatively rare in the population and small cell sizes may have resulted in imprecise estimates.

The present findings support past research indicating a relationship between the experience of IPV and poorer physical (Bonomi et al., 2007; Coker et al., 2002; Devries et al., 2013; Dutton et al., 2004; Gierisch et al., 2013; Hurwitz et al., 2006; Loeb et al., 2014; Lown & Vega, 2001; Staggs & Riger, 2005; Sutherland et al., 2001) and mental (Campbell, 2002; Coker et al., 2002; Devries et al., 2013; Dutton et al., 2004; Ellsberg et al., 1999; Gierisch et al., 2013; Golding, 1999; Hurwitz et al., 2006; Loeb et al., 2014; Tolman & Rosen, 2001; Woods, 2000; Zilberman & Blume, 2005) health in women and men. The current findings also reinforce the position that biopsychosocial stressors, including actual and/or perceived threat, precipitate problems initiating and/or maintaining sleep (Ellis et al., 2012; Perlis et al., 1997; Perlis et al., 2010). The present findings also support the work of Hurwitz and colleagues (2006) and Pigeon and colleagues (2011) by illustrating the nature of the relationship between sleep disturbance and IPV. Furthermore, the present study expands on the findings of Pigeon and colleagues (2011) and Staggs and Riger (2005) through the utilization of mediation analyses. Specifically, the present findings examine specific domains of IPV (e.g., threatened, hurt in the last year) and support previous conclusions that disturbed sleep is a mediating factor for health in the context of IPV.

Beyond adding to the existing literature, the present findings are clinically relevant, because insomnia is highly treatable using cognitive behavioral therapy for insomnia (CBTI), a short-term, non-pharmacological treatment for insomnia (Mitchell, Gehrman, Perlis, & Umscheid, 2012). CBTI provides the client with tools to change the thoughts and behavior patterns that maintain insomnia, regardless of the cause. It has been proven effective in providing long-term alleviation of sleep disturbance, in people with and without co-occurring mental disorders, such as PTSD (Edinger et al., 2009; Germain, Shear, Hall, & Buysse, 2007; Mitchell et al., 2012; Perlis et al., 2010; Ulmer, Edinger, & Calhoun, 2011). Although previous studies have not examined CBTI specifically in the context of IPV, this approach may provide the opportunity to reduce sleep disturbance in people who have experienced

IPV, potentially mitigating the effects of both IPV and sleep disturbance on physical and mental health.

Strengths

The primary strength of such a large-scale national surveys lies in its external validity, with substantial quantity of subjects, randomly sampled across seven diverse American states and one territory increasing the power and generalizability of the associations of sleep disturbance with IPV its ensuing health consequences. Furthermore, the inclusion of sampling weights enhances generalizability. A second strength of this study was the variable ways in which IPV was assessed, across verbal, physical, and sexual domains. Other strengths included the inclusion of both men and women, a generalizable sleep disturbance item that has been relatively well-characterized in the existing literature, and the analytic approach, which leverages mediation analyses to examine the role of sleep in IPV and physical/mental health.

Limitations

Although using data from epidemiologic surveys such as BRFSS has major methodological strengths, there are still some identifiable limitations. First, the nature of a large telephone survey utilizing random digit dial limits the generalizability to all people who experienced IPV, due to exclusion of people without access to a telephone or landline phone are not eligible to participate. This may have led to a potential underestimation of IPV and its association with sleep disturbance. The sensitive nature of IPV may influence the termination or refusal to completion rate of 15% to 31%, leading to another potential underestimation of IPV and its association with sleep disturbance. Second, the data were collected 8 years ago, so interpretations of these data should be made in the context of 2006. Although the effect of these issues reduced using weighted analyses, the nature of the generalizability of telephone surveys of IPV remains challenged.

Within the questions themselves, the sleep disturbance item assesses three separate sleep-related complaints using only one question. Other medical concerns such as apnea or narcolepsy are at risk of being captured by the terms “difficulty staying asleep or sleeping too much,” whereas reports of trouble falling asleep may be either insomnia or a psychological concern such as depression. This limits interpretation. The physical and mental health measures bear similar concerns, as they are not specific regarding symptoms or diagnosis of mental or physical health problems. Another limitation is that data on the gender of the perpetrator(s) and the sexual orientation of the participants were not assessed, limiting the knowledge of the effects of these important variables on our measures. Also, the cross-sectional nature of these data limits the determination of causality.

Conclusion

In sum, sleep partially mediates the relationship between the experience of IPV and physical/mental health. The present findings both validate and expand upon the existing body of knowledge on IPV in men and women. Clinical applications of the current research

could include efforts to more thoroughly and directly address sleep issues when assisting victims of IPV in an effort to mitigate the physical/mental health effects. Given the existence of non-pharmacological, effective treatment strategies for poor sleep, the association between IPV and sleep disturbance, and the role of both IPV and sleep disturbance in health outcomes, sleep disturbance in men and women who experienced IPV are an important target for clinical applications and in future research. Furthermore, future research might seek to replicate the present findings internationally and in the specific context of same-sex couples, understanding whether sexual and gender orientation impact the health associations with IPV.

Acknowledgments

We wish to thank the Centers for Disease Control and Prevention for collecting these data and making them available, and the Behavioral Risk Factor Surveillance System participants.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Supported by R21ES022931, K23HL110216, UL1RR024134, R01AT003332, and R01MH077900.

Author Biographies

Linden Lalley-Chareczko is a research assistant for multiple studies within the Behavioral Sleep Medicine Program at the University of Pennsylvania involving patients who have insomnia alone, or insomnia and a history of depression or cancer. She also volunteers as a research assistant for two laboratories at the Philadelphia College of Osteopathic Medicine (PCOM). At PCOM, she assisted in the creation of a treatment manual aimed at promoting hope and treatment adherence in dually diagnosed populations. She also conducts clinical interviews and assists in qualitative data analysis. She graduated from Lebanon Valley College with her bachelor's degree in psychology and from the John Jay College of Criminal Justice with a master's degree in forensic psychology. While at John Jay, she worked as a research assistant within a study evaluating the civil commitment system for dangerous sexual offenders in the state of New Jersey. She also works at the Jonathan Lax Treatment Center as part of the Philadelphia FIGHT Community Health Centers.

Andrea Segal is currently a research assistant with the Behavioral Sleep Medicine Program. She is also a student in the master of science program in psychology at Drexel University, researching clinical health psychology, and life skills training programs for veterans. She earned her bachelor of arts degree in psychology and political science at Cornell University. Prior to beginning her graduate studies at Drexel, she worked as a counselor and medical assistant at a general health care clinic, and gained research experience at the University of Pennsylvania as part of the behavioral sleep medicine program where she has been involved mainly in recruitment and data management, as well as applying her clinical health skills. She also served as research coordinator at the School of Nursing on projects relating to the clinical care of autism spectrum disorders.

Michael L. Perlis is an associate professor of psychology in the Department of Psychiatry and the director of the behavioral sleep medicine Program. His areas of expertise include

sleep in psychiatric disorders and neurocognitive phenomena in insomnia, the cognitive and behavioral mechanisms of action of sedative hypnotics and placebos, and the development of alternative treatments for insomnia. His clinical expertise is in the area of behavioral sleep medicine (BSM), and he is the principle author of the first text book in this field (*Treating Sleep Disorders: The Principles and Practice of Behavioral Sleep Medicine*, Wiley & Sons) and is the senior author of two textbooks on behavioral sleep medicine interventions for sleep disorders (Springer and Academic Press). He has also authored or co-authored a variety of papers and chapters on the assessment and treatment of sleep disorders and published more than 90 empirical or theoretical articles and commentaries and chapters on sleep-related topics. He is on the editorial boards of the journals *Sleep*, *The Journal of Sleep Research*, *The Journal of Sleep Medicine Research*, and *The Journal of Behavioral Sleep medicine*.

Sara Nowakowski is an assistant professor in the Department of Obstetrics and Gynecology and the Department of Psychiatry and Behavioral Sciences at University of Texas Medical Branch in Galveston, Texas. Her research and clinical specialty is in behavioral sleep medicine, women's health, and aging. She has grants funded by the National Institutes of Health and Hogg Foundation to develop and test a behavioral intervention for insomnia and hot flashes in menopausal women. Other current research projects include, examining sleep and psychological well-being in women undergoing hysterectomy, and examining the effect of physical inactivity and subsequent inpatient rehabilitation on sleep in bedridden older adults. Her work to date has culminated in 62 peer-reviewed articles, book chapters, and abstracts, and 17 presentations at national conferences.

Joshua Z. Tal is a PhD candidate in clinical psychology at Palo Alto University with an emphasis on women's health and neuroscience through Stanford University School of Medicine. He is also boarded sleep technician Registered Polysomnographic Technician (RPSGT) by trade. His research interests include sleep disorders, women's health, and psychiatric comorbidities. His dissertation utilizes sleep and psycho-pathology data collected at Stanford University's Late-Life and Lifespan Approach to Neuropsychiatric Disorders Lab. His dissertation examines the gender differences in the association of sleep apnea with depressive symptoms in late-life adults.

Michael A. Grandner is an assistant professor at the University of Arizona and was recently an instructor in the Department of Psychiatry and a member of the Center for Sleep and Circadian Neurobiology at the Perelman School of Medicine at the University of Pennsylvania. He completed his graduate training in clinical psychology at San Diego State University and the University of California, San Diego, including an internship with the behavioral medicine service at the San Diego Veterans Affairs Health Care System and Outpatient Psychiatric Services at the University of California, San Diego. Subsequently, he completed an American Academy of Sleep Medicine accredited fellowship in behavioral sleep medicine at Penn in the context of a National Heart Lung and Blood Institute sponsored postdoctoral fellowship through the Division of Sleep Medicine. His research interests include (a) adverse cardiovascular, metabolic, and behavioral health outcomes associated with short sleep and/or insufficient sleep; (b) biopsychosocial determinants of short sleep, insufficient sleep, and poor sleep quality; and (c) behavioral interventions for

sleep as a domain of health behavior. In summary, his research aims to better understand the downstream adverse outcomes of insufficient or poor quality sleep, the upstream determinants of sleep and sleep behaviors, and how knowledge of sleep determinants can inform behavioral interventions for adverse outcomes. This work bridges the bench to bedside to community to population divide, including mechanistic and translational studies of sleep and cardiometabolic disease risk, clinical pheno-typing and intervention studies, studies of sleep and health disparities, and epidemio-logic studies of sleep and cardiovascular and metabolic disease.

References

- Altman NG, Izci-Balserak B, Schopfer E, Jackson N, Rattanaumpawan P, Gehrman PR, Grandner MA. Sleep duration versus sleep insufficiency as predictors of cardiometabolic health outcomes. *Sleep Medicine*. 2012; 13:1261–1270. DOI: 10.1016/j.sleep.2012.08.005 [PubMed: 23141932]
- Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*. 1986; 51(6):1173. [PubMed: 3806354]
- Black MC, Basile KC, Breiding MJ, Smith SG, Walters ML, Merrick MT, Stevens MR. The national intimate partner and sexual violence survey: 2010 summary report. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention; Atlanta, GA: 2011.
- Bonomi AE, Anderson ML, Rivara FP, Thompson RS. Health outcomes in women with physical and sexual intimate partner violence exposure. *Journal of Women's Health*. 2007; 16:987–997. DOI: 10.1089/jwh.2006.0239
- Buysse DJ, Germain A, Hall M, Monk TH, Nofzinger EA. A neurobiological model of insomnia. *Drug Discovery Today: Disease Models*. 2011; 8:129–137. DOI: 10.1016/j.ddmod.2011.07.002 [PubMed: 22081772]
- Campbell JC. Health consequences of intimate partner violence. *The Lancet*. 2002; 359:1331–1336. DOI: 10.1016/S0140-6736(02)08336-8
- Campbell JC, Lewandowski LA. Mental and physical health effects of intimate partner violence on women and children. *Psychiatric Clinics of North America*. 1997; 20:353–374. [PubMed: 9196919]
- Centers for Disease Control and Prevention. BRFSS 2006 summary data quality report. Department of Health and Human Services, Centers for Disease Control and Prevention; Atlanta, GA: 2007.
- Coker AL, Davis KE, Arias I, Desai S, Sanderson M, Brandt HM, Smith PH. Physical and mental health effects of intimate partner violence for men and women. *American Journal of Preventive Medicine*. 2002; 23:260–268. [PubMed: 12406480]
- Colten HR, Altevogt BM. Institute of Medicine Committee on Sleep Medicine and Research. *Sleep disorders and sleep deprivation: An unmet public health problem*. Institute of Medicine: National Academies Press; Washington, DC: 2006.
- Devries KM, Mak JY, Bacchus LJ, Child JC, Falder G, Petzold M, Watts CH. Intimate partner violence and incident depressive symptoms and suicide attempts: A systematic review of longitudinal studies. *PLoS Medicine*. 2013; 10(5):e1001439.doi: 10.1371/journal.pmed.1001439 [PubMed: 23671407]
- Dutton MA, Goodman LA, Lennig DJ, Murphy JC. Longitudinal patterns of intimate partner violence, risk, well-being, and employment: Preliminary findings. National Institute of Justice; Rockville, MD: 2004.
- Edinger JD, Olsen MK, Stechuchak KM, Means MK, Lineberger MD, Kirby A, Carney CE. Cognitive behavioral therapy for patients with primary insomnia or insomnia associated predominantly with mixed psychiatric disorders: A randomized clinical trial. *Sleep*. 2009; 32:499–510. [PubMed: 19413144]
- Ellis JG, Gehrman P, Espie CA, Riemann D, Perlis ML. Acute insomnia: Current conceptualizations and future directions. *Sleep Medicine Reviews*. 2012; 16:5–14. S1087-0792(11)00026-8 [pii]. DOI: 10.1016/j.smr.2011.02.002 [PubMed: 21596596]

- Ellsberg M, Caldera T, Herrera A, Winkvist A, Kullgren G. Domestic violence and emotional distress among Nicaraguan women. *American Psychologist*. 1999; 54:30–36.
- Gandini S, Botteri E, Iodice S, Boniol M, Lowenfels AB, Maisonneuve P, Boyle P. Tobacco smoking and cancer: A meta-analysis. *International Journal of Cancer*. 2008; 122:155–164. DOI: 10.1002/ijc.23033 [PubMed: 17893872]
- Germain A, Shear MK, Hall M, Buysse DJ. Effects of a brief behavioral treatment for PTSD-related sleep disturbances: A pilot study. *Behaviour Research and Therapy*. 2007; 45:627–632. [PubMed: 16777060]
- Gierisch JM, Shapiro A, Grant NN, King HA, McDuffie JR, Williams JW. Intimate partner violence: Prevalence among US military veterans and active duty servicemembers and a review of intervention approaches. Department of Veterans Affairs; Washington, DC: 2013.
- Golding JM. Intimate partner violence as a risk factor for mental disorders: A meta-analysis. *Journal of Family Violence*. 1999; 14:99–132.
- Grandner MA, Buxton OM, Jackson N, Sands-Lincoln M, Pandey A, Jean-Louis G. Extreme sleep durations and increased C-reactive protein: Effects of sex and ethnoracial group. *Sleep*. 2013; 36:769–779. DOI: 10.5665/sleep.2646 [PubMed: 23633760]
- Grandner MA, Hale L, Jackson N, Patel NP, Gooneratne NS, Troxel WM. Perceived racial discrimination as an independent predictor of sleep disturbance and daytime fatigue. *Behavioral Sleep Medicine*. 2012; 10:235–249. DOI: 10.1080/15402002.2012.654548 [PubMed: 22946733]
- Grandner MA, Jackson NJ, Pak VM, Gehrman PR. Sleep disturbance is associated with cardiovascular and metabolic disorders. *Journal of Sleep Research*. 2012; 21:427–433. DOI: 10.1111/j.1365-2869.2011.00990.x [PubMed: 22151079]
- Grandner MA, Jackson NJ, Pigeon WR, Gooneratne NS, Patel NP. State and regional prevalence of sleep disturbance and daytime fatigue. *Journal of Clinical Sleep Medicine*. 2012; 8:77–86. DOI: 10.5664/jcsm.1668 [PubMed: 22334813]
- Grandner MA, Martin JL, Patel NP, Jackson NJ, Gehrman PR, Pien G, Gooneratne NS. Age and sleep disturbances among American men and women: Data from the U.S. Behavioral risk factor surveillance system. *Sleep*. 2012; 35:395–406. DOI: 10.5665/sleep.1704 [PubMed: 22379246]
- Grandner MA, Patel NP, Gehrman PR, Xie D, Sha D, Weaver T, Gooneratne N. Who gets the best sleep? Ethnic and socioeconomic factors related to sleep disturbance. *Sleep Medicine*. 2010; 11:470–479. [PubMed: 20388566]
- Grandner MA, Patel NP, Hale L, Moore M. Mortality associated with sleep duration: The evidence, the possible mechanisms, and the future. *Sleep Medicine Reviews*. 2010; 14:191–203. [PubMed: 19932976]
- Grandner MA, Patel NP, Perlis ML, Gehrman PR, Xie D, Sha D, Gooneratne NS. Obesity, diabetes, and exercise associated with sleep-related complaints in the American population. *Journal of Public Health*. 2011; 19:463–474. DOI: 10.1007/s10389-011-0398-2 [PubMed: 22791935]
- Hayes AL, Xu F, Babineau D, Patel SR. Sleep duration and circulating adipokine levels. *Sleep*. 2011; 34:147–152. [PubMed: 21286230]
- Holt VL, Kernic MA, Lumley T, Wolf ME, Rivara FP. Civil protection orders and risk of subsequent police-reported violence. *Journal of the American Medical Association*. 2002; 288:589–594. [PubMed: 12150670]
- Hurwitz EJ, Gupta J, Liu R, Silverman JG, Raj A. Intimate partner violence associated with poor health outcomes in U.S. South Asian women. *Journal of Immigrant and Minority Health*. 2006; 8:251–261. DOI: 10.1007/s10903-006-9330-1 [PubMed: 16791535]
- Kernic MA, Wolf ME, Holt VL. Rates and relative risk of hospital admission among women in violent intimate partner relationships. *American Journal of Public Health*. 2000; 90:1416–1420. [PubMed: 10983199]
- Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. *Archives of General Psychiatry*. 2002; 59:131–136. doi:yoa20380 [pii]. [PubMed: 11825133]
- Loeb TB, Holloway IW, Galvan FH, Wyatt GE, Myers HF, Glover DA, Liu H. Associations between intimate partner violence and post-traumatic stress symptom severity in a multiethnic sample of

men with histories of childhood sexual abuse. *Violence and Victims*. 2014; 29:451–463. [PubMed: 25069149]

Lown EA, Vega WA. Intimate partner violence and health: Self-assessed health, chronic health, and somatic symptoms among Mexican American women. *Psychosomatic Medicine*. 2001; 63:352–360. [PubMed: 11382262]

Matud MP. The psychological impact of domestic violence on Spanish women. *Journal of Applied Social Psychology*. 2005; 35:2310–2322.

McCauley J, Kern DE, Kolodner K, Derogatis LR, Bass EB. Relation of low-severity violence to women's health. *Journal of General Internal Medicine*. 1998; 13:687–691. [PubMed: 9798816]

Mitchell MD, Gehrman P, Perlis M, Umscheid CA. Comparative effectiveness of cognitive behavioral therapy for insomnia: A systematic review. *BMC Family Practice*. 2012; 13(1) Article 40.

Patel SR, Zhu X, Storfer-Isser A, Mehra R, Jenny NS, Tracy R, Redline S. Sleep duration and biomarkers of inflammation. *Sleep*. 2009; 32:200–204. [PubMed: 19238807]

Perlis ML, Giles DE, Mendelson WB, Bootzin RR, Wyatt JK. Psychophysiological insomnia: The behavioural model and a neurocognitive perspective. *Journal of Sleep Research*. 1997; 6:179–188. [PubMed: 9358396]

Perlis ML, Shaw P, Cano G, Espie C. Models of insomnia. In: Kryger M, Roth T, Dement WC, editors *Principles and practice of sleep medicine*. 5th. Elsevier; Philadelphia, PA: 2010. 850–865.

Pigeon WR, Cerulli C, Richards H, He H, Perlis M, Caine E. Sleep disturbances and their association with mental health among women exposed to intimate partner violence. *Journal of Women's Health*. 2011; 20:1923–1929. DOI: 10.1089/jwh.2011.2781

Ratner PA. The incidence of wife abuse and mental health status in abused wives in Edmonton, Alberta. *Canadian Journal of Public Health*. 1993; 84:246–249. [PubMed: 8221497]

Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*. 2009; 373:2223–2233.

Resnick HS, Acierno R, Kilpatrick DG. Health impact of interpersonal violence. 2: Medical and mental health outcomes. *Behavioral Medicine*. 1997; 23:65–78. DOI: 10.1080/08964289709596730 [PubMed: 9309346]

Romans SE, Cohen MM, Forte T, Du Mont J, Hyman I. Gender and psychotropic medication use: The role of intimate partner violence. *Preventive Medicine*. 2008; 46:615–621. DOI: 10.1016/j.ypmed.2007.07.019 [PubMed: 18395784]

Sobel ME. Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology*. 1982; 13:290–312.

Sobel ME. New results on indirect effects and their standard errors in covariance structure models. *Sociological Methodology*. 1986; 16:159–186.

Staggs SL, Riger S. Effects of intimate partner violence on low-income women's health and employment. *American Journal of Community Psychology*. 2005; 36:133–145. DOI: 10.1007/s10464-005-6238-1 [PubMed: 16134050]

Sutherland CA, Sullivan CM, Bybee D. Effects of intimate partner violence versus poverty on women's health. *Violence Against Women*. 2001; 7:1122–1143.

Tolman RM, Rosen D. Domestic violence in the lives of women receiving welfare. *Violence Against Women*. 2001; 7:141–158.

Truman JL, Smith EL. Prevalence of violent crime among households with children, 1993–2010. Bureau of Justice Statistics; Washington, DC: 2012.

Ulmer CS, Edinger JD, Calhoun PS. A multi-component cognitive-behavioral intervention for sleep disturbance in veterans with PTSD: A pilot study. *Journal of Clinical Sleep Medicine*. 2011; 7:57–68. [PubMed: 21344046]

Watanabe M, Kikuchi H, Tanaka K, Takahashi M. Association of short sleep duration with weight gain and obesity at 1-year follow-up: A large-scale prospective study. *Sleep*. 2010; 33:161–167. [PubMed: 20175399]

Wells KB, Golding JM, Burnam MA. Chronic medical conditions in a sample of the general population with anxiety, affective, and substance use disorders. *American Journal of Psychiatry*. 1989; 146:1440–1446. [PubMed: 2817115]

- Woods SJ. Prevalence and patterns of posttraumatic stress disorder in abused and post-abused women. *Issues in Mental Health Nursing*. 2000; 21:309–324. [PubMed: 11075070]
- Zilberman ML, Blume SB. Domestic violence, alcohol and substance abuse. *Revista Brasileira de Psiquiatria*. 2005; 27(Suppl. 2):S51–S55. DOI: 10.1590/S1516-44462005000600004 [PubMed: 16302054]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Characteristics of the Sample, Stratified by Sleep Disturbance.

Variable	Category	Complete Sample	Sleep Disturbance		p
			No	Yes	
Age	<i>M</i> ± <i>SD</i>	45.838 ± 17.769	45.664 ± 17.646	44.660 ± 17.637	<.0001
Sex	Female	51.437%	49.678%	58.467%	<.0001
Race/ethnicity	White	69.295%	66.662%	68.538%	<.0001
	Black/African American	9.329%	8.993%	9.425%	
	Hispanic/Latino	14.918%	17.847%	14.930%	
	Asian/Other	6.459%	6.498%	7.106%	
Income	<\$10,000	5.296%	4.849%	9.554%	<.0001
	\$10,000-\$15,000	5.277%	4.909%	8.448%	
	\$15,000-\$20,000	7.326%	6.683%	9.947%	
	\$20,000-\$25,000	8.794%	8.706%	11.057%	
	\$25,000-\$35,000	12.184%	12.190%	13.368%	
	\$35,000-\$50,000	15.425%	15.561%	14.714%	
	\$50,000-\$75,000	17.298%	17.912%	14.007%	
	>\$75,000	28.400%	29.189%	18.904%	
Education	Less than high school	12.068%	12.205%	16.254%	<.0001
	High school graduate	29.223%	27.672%	32.359%	
	Some college	26.222%	26.407%	28.461%	
	College graduate	32.487%	33.716%	22.926%	
Marital status	Married	59.678%	62.389%	50.555%	<.0001
	Divorced	8.944%	8.444%	12.807%	
	Widowed	6.483%	5.952%	6.984%	
	Separated	2.200%	1.854%	3.766%	
	Never married	18.497%	17.318%	20.780%	
	Part of an unmarried couple	4.198%	4.043%	5.107%	
Employment	Employed	52.438%	54.540%	41.102%	<.0001
	Self-employed	8.778%	9.404%	7.878%	
	Home maker	8.143%	8.208%	9.117%	

Variable	Category	Complete Sample	Sleep Disturbance		<i>p</i>
			No	Yes	
	Student	4.636%	4.462%	4.896%	
	Retired	15.999%	16.150%	13.909%	
	Unemployed <1 yr	3.086%	2.531%	5.494%	
	Unemployed >1 yr	1.963%	1.589%	3.669%	
	Unable to work	4.957%	3.115%	13.934%	
Days poor physical health (<i>M</i> ± <i>SD</i>)		3.565 ± 7.914	2.645 ± 6.678	7.844 ± 11.202	<.0001
Days poor mental health (<i>M</i> ± <i>SD</i>)		3.403 ± 7.507	2.208 ± 5.718	8.995 ± 11.296	<.0001
Intimate partner threaten ever (THREAT)		12.867%	10.137%	23.994%	<.0001
Intimate partner hurt ever (HURT)		14.463%	11.586%	26.013%	<.0001
Intimate partner sex ever (SEX)		6.030%	4.373%	12.893%	<.0001
Intimate partner sex or hurt past year (SEXyr)		0.774%	0.339%	2.563%	<.0001
Intimate partner injury past year (HURTyr)		0.339%	0.152%	1.125%	<.0001

Table 2

Regression Results for Relationships Between Intimate Partner Violence and Sleep Disturbance, Unadjusted and After Adjustment for Covariates for the Overall Sample and Stratified by Sex.

Variable	Unadjusted			Adjusted		
	OR	95% CI	p	OR	95% CI	p
Intimate partner threaten ever	2.497	[2.171, 2.872]	<.0001	2.798	[2.455, 3.190]	<.0001
Intimate partner hurt ever	2.409	[2.112, 2.748]	<.0001	2.683	[2.368, 3.040]	<.0001
Intimate partner sex ever	2.718	[2.248, 3.286]	<.0001	3.237	[2.706, 3.871]	<.0001
Intimate partner sex or hurt past year	4.973	[2.693, 9.184]	<.0001	7.741	[4.284, 13.987]	<.0001
Intimate partner injury past year	4.406	[1.906, 10.183]	.0005	7.497	[3.347, 16.794]	<.0001
Women only						
Intimate partner threaten ever	2.654	[2.291, 3.076]	<.0001	2.558	[2.199, 2.975]	<.0001
Intimate partner hurt ever	2.764	[2.397, 3.187]	<.0001	2.617	[2.266, 3.021]	<.0001
Intimate partner sex ever	2.855	[2.369, 3.442]	<.0001	2.740	[2.257, 3.327]	<.0001
Intimate partner sex or hurt past year	6.641	[3.331, 13.242]	<.0001	4.967	[2.413, 10.225]	<.0001
Intimate partner injury past year	5.911	[2.445, 14.291]	.0001	3.937	[1.576, 9.836]	.0033
Men only						
Intimate partner threaten ever	2.627	[2.015, 3.425]	<.0001	2.416	[1.805, 3.235]	<.0001
Intimate partner hurt ever	2.202	[1.740, 2.787]	<.0001	2.065	[1.583, 2.693]	<.0001
Intimate partner sex ever	3.657	[1.976, 6.767]	<.0001	2.662	[1.377, 5.148]	.0036
Intimate partner sex or hurt past year	9.048	[3.086, 26.525]	.0001	5.556	[1.616, 19.099]	.0065
Intimate partner injury past year	12.465	[1.991, 78.045]	.0070	7.821	[1.286, 47.541]	.0255

Note. Adjusted for age, sex, race/ethnicity, income, education, employment, marital status, physical health and mental health. OR = odds ratio; CI = confidence interval.

Table 3

Regression Results for Relationships Between Intimate Partner Violence and Sleep Disturbance, Unadjusted and After Adjustment for Covariates Stratified by Race/Ethnicity.

Variable	Unadjusted			Adjusted		
	OR	95% CI	p	OR	95% CI	p
Non-Hispanic White						
Intimate partner threaten ever	2.892	[2.491, 3.357]	<.0001	2.598	[2.227, 3.032]	<.0001
Intimate partner hurt ever	2.613	[2.259, 3.022]	<.0001	2.337	[2.014, 2.711]	<.0001
Intimate partner sex ever	3.098	[2.512, 3.822]	<.0001	2.563	[2.054, 3.199]	<.0001
Intimate partner sex or hurt past year	10.036	[4.323, 23.296]	<.0001	6.747	[2.849, 15.979]	<.0001
Intimate partner injury past year	7.893	[2.696, 23.112]	.0002	4.390	[1.334, 14.447]	.0149
Black/African American						
Intimate partner threaten ever	2.359	[1.555, 3.577]	.0001	2.255	[1.423, 3.574]	.0005
Intimate partner hurt ever	2.554	[1.777, 3.672]	<.0001	2.351	[1.584, 3.489]	<.0001
Intimate partner sex ever	3.112	[1.765, 5.485]	.0001	2.450	[1.380, 4.352]	.0022
Intimate partner sex or hurt past year	3.095	[1.142, 8.388]	.0264	2.223	[0.660, 7.490]	.1973
Intimate partner injury past year	1.439	[0.252, 8.226]	.6823	1.385	[0.228, 8.404]	.7236
Hispanic/Latino						
Intimate partner threaten ever	2.513	[1.132, 5.579]	.0235	1.908	[0.752, 4.840]	.1735
Intimate partner hurt ever	2.788	[1.379, 5.637]	.0043	2.772	[1.552, 4.951]	.0006
Intimate partner sex ever	2.858	[1.204, 6.783]	.0172	3.228	[1.367, 7.623]	.0075
Intimate partner sex or hurt past year	1.342	[0.189, 9.514]	.7684	0.043	[0.006, 0.288]	.0012
Intimate partner injury past year	1.807	[0.162, 20.117]	.6305	0.038	[0.003, 0.460]	.0101
Asian/Other						
Intimate partner threaten ever	2.806	[1.946, 4.046]	<.0001	2.310	[1.566, 3.409]	<.0001
Intimate partner hurt ever	3.281	[2.301, 4.679]	<.0001	3.059	[2.112, 4.431]	<.0001
Intimate partner sex ever	4.581	[2.898, 7.242]	<.0001	4.038	[2.550, 6.395]	<.0001
Intimate partner sex or hurt past year	24.106	[7.112, 81.700]	<.0001	14.949	[4.772, 46.830]	<.0001
Intimate partner injury past year	43.872	[8.889, 216.538]	<.0001	33.562	[6.654, 169.296]	<.0001

Note. OR = odds ratio; CI = confidence interval.

Table 4
Analysis of Whether the Relationship of Intimate Partner Violence and Mental/Physical Health Is Partially Mediated by Sleep Disturbance.

Predictor Variable	Specific Effects			Effect Mediation	Sobel–Goodman Test	
	Path C1 (<i>p</i>)	Path A (<i>p</i>)	Path B (<i>p</i>)	Path C2 (<i>p</i>)	Proportion of Mediation	<i>p</i>
Complete sample						
Days of poor mental health						
Intimate partner threaten ever	<.0001	<.0001	<.0001	<.0001	0.292	3.588706 .0003
Intimate partner hurt ever	<.0001	<.0001	<.0001	<.0001	0.297	3.579499 .0003
Intimate partner sex ever	<.0001	<.0001	<.0001	<.0001	0.256	3.546629 .0004
Intimate partner sex or hurt past year	<.0001	<.0001	<.0001	<.0001	0.205	3.497738 .0005
Intimate partner injury past year	<.0001	.0017	<.0001	.0001	0.181	3.469192 .0005
Days of poor physical health						
Intimate partner threaten ever	<.0001	<.0001	<.0001	<.0001	0.357	6.388999 <.0001
Intimate partner hurt ever	<.0001	<.0001	<.0001	<.0001	0.407	6.333259 <.0001
Intimate partner sex ever	<.0001	<.0001	<.0001	.0004	0.350	6.248938 <.0001
Intimate partner sex or hurt past year	.2951	<.0001	<.0001	.8565	N/A	N/A
Intimate partner injury past year	.0064	.0029	<.0001	.0342	0.260	6.149462 <.0001
Women only						
Days of poor mental health						
Intimate partner threaten ever	<.0001	<.0001	<.0001	<.0001	0.291	3.612544775 .0003
Intimate partner hurt ever	<.0001	<.0001	<.0001	<.0001	0.314	3.605073214 .0003
Intimate partner sex ever	<.0001	<.0001	<.0001	<.0001	0.300	3.540104628 .0004
Intimate partner sex or hurt past year	<.0001	<.0001	<.0001	<.0001	0.244	3.457737446 .0005
Intimate partner injury past year	.0008	.0121	<.0001	.0016	0.197	3.430380106 .0006
Days of poor physical health						
Intimate partner threaten ever	<.0001	<.0001	<.0001	<.0001	0.271	6.644325733 <.0001
Intimate partner hurt ever	<.0001	<.0001	<.0001	<.0001	0.337	6.566871166 <.0001
Intimate partner sex ever	<.0001	<.0001	<.0001	<.0001	0.326	6.45510006 <.0001
Intimate partner sex or hurt past year	.6381	.0001	<.0001	.7297	N/A	N/A
Intimate partner injury past year	.0134	.0178	<.0001	.0848	0.321	6.233130455 <.0001

Predictor Variable	Specific Effects			Effect Mediation Proportion of Mediation	Sobel–Goodman Test	
	Path C1 (<i>p</i>)	Path A (<i>p</i>)	Path B (<i>p</i>)	Path C2 (<i>p</i>)	Z score	<i>p</i>
Men only						
Days of poor mental health						
Intimate partner threaten ever	<.0001	<.0001	<.0001	.0001	3.618682	.0003
Intimate partner hurt ever	<.0001	<.0001	<.0001	<.0001	3.612027	.0003
Intimate partner sex ever	.0029	.0916	<.0001	.0031	N/A	N/A
Intimate partner sex or hurt past year	<.0001	.0040	<.0001	<.0001	3.621498	.0003
Intimate partner injury past year	.0016	.0581	<.0001	.0014	N/A	N/A
Days of poor physical health						
Intimate partner threaten ever	.1669	<.0001	<.0001	.8801	N/A	N/A
Intimate partner hurt ever	.0884	<.0001	<.0001	.5018	N/A	N/A
Intimate partner sex ever	.4510	.1174	<.0001	.6396	N/A	N/A
Intimate partner sex or hurt past year	.0766	.0033	<.0001	.1843	N/A	N/A
Intimate partner injury past year	.0238	.0573	<.0001	.0255	N/A	N/A

Note. Path A refers to the association between IPV and sleep disturbance, Path B refers to the association between sleep disturbance and mental/physical health in the context of IPV, Path C1 refers to the association between IPV and mental/physical health, and Path C2 refers to that association in the context of Path B. The proportion of mediation refers to the proportion of the effect of path C1 accounted for by Path B.