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ORIGINAL ARTICLE

Intimate Partner Violence, Mental Health, and Associations with Self-Reported and Objective Sleep Quality in Pregnancy

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Abstract

Purpose This study investigates the interplay between intimate partner violence (IPV), mental health symptoms (posttraumatic stress, depression, and anxiety), and sleep quality in pregnant women. It examines the alignment between subjective (self-reported) and objective (actigraphy) measures of sleep and explores how IPV subtypes (physical violence, psychological aggression, and sexual coercion) influence these measures, considering the potential mediating role of mental health.

Methods The study involved 46 pregnant women with a history of IPV exposure within the past year or serving as controls. Participants completed surveys assessing IPV, mental health, and self-reported sleep quality, followed by seven days of actigraphy monitoring. Statistical analyses included Spearman correlations, Bland–Altman plots for sleep measure agreement, and path analyses to explore relationships between IPV, mental health symptoms, and sleep parameters.

Results Moderate correlations were observed between subjective and objective measures for time in bed and sleep onset latency (SOL). IPV subtypes showed distinct associations with sleep parameters: physical violence directly impacted total sleep time and efficiency, while sexual coercion influenced SOL. Mental health symptoms did not mediate these relationships significantly. Discrepancies between subjective and objective sleep measures highlighted potential biases linked to IPV exposure.

Conclusion IPV exposure significantly disrupts sleep during pregnancy, with unique effects observed for different IPV subtypes. These disturbances occur independently of mental health symptoms, underscoring the need for routine sleep assessments and tailored interventions in prenatal care for IPV-exposed women. Integrating subjective and objective sleep evaluations can enhance understanding and management of sleep disturbances in this vulnerable population.

Keywords Domestic violence · Sleep · Perinatal · Psychopathology

1 Introduction

Intimate partner violence (IPV) is defined as completed or threatened acts of physical, sexual, or psychological harm by a current or former partner [1]. In the U.S., an estimated 1.5 million women experience violence enacted by former or current intimate partners each year, with approximately 25–50% of women reporting exposure in their adult lifetime [2]. Although IPV may occur at any stage throughout the lifespan, pregnancy is a unique period of vulnerability; during this time, IPV places both the mother and the unborn child at great risk for detrimental health outcomes [3]. Moreover, pregnancy involves a number of physiological, emotional, and social changes, which have been linked to heightened risk for poor mental health [4]. These changes can be compounded by the experience of IPV during the perinatal period, which is associated with additional risk for depression [5], anxiety [6], posttraumatic stress disorder (PTSD) [7], and poor sleep [8].

The relationship between mental health and sleep is complex and bidirectional. Mental health symptoms, such as anxiety, depression, and PTSD, are well-established contributors to sleep disturbances [9]. Conversely, poor sleep has been shown to exacerbate or even precipitate mental health symptoms, highlighting its role as both a driver and an outcome of psychopathology [10]. Pregnancy, as a period of heightened vulnerability to mental health issues, provides

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a unique context in which this bidirectional relationship may be especially pronounced. Given that IPV increases risk for both poor mental health and sleep disturbances, it is essential to examine how these constructs interact. Specifically, understanding the mediating role of mental health in the IPV-sleep relationship could provide critical insights into the pathways through which IPV impacts sleep during pregnancy.

Sleep is a multidimensional construct that encompasses various parameters, including quality, duration, efficiency, latency, and regularity. Each of these dimensions offers distinct insights into sleep health. Sleep quality, typically assessed through subjective reports, refers to an individual's perception of restfulness and satisfaction with their sleep. Poor sleep quality has been linked to increased risk of depression, anxiety, and impaired cognitive functioning [9]. Sleep latency, or the time it takes to fall asleep, serves as an indicator of underlying physiological or psychological arousal; prolonged sleep latency is often observed in individuals with anxiety disorders or hypervigilance [11]. Sleep efficiency, which reflects the proportion of time spent asleep relative to time spent in bed, can be assessed objectively through actigraphy or polysomnography (PSG) and is a marker of overall sleep consolidation. Low sleep efficiency is associated with insomnia, fragmented sleep, and chronic pain conditions [12]. Finally, sleep duration refers to the total time spent asleep in a 24-h period, with insufficient duration linked to adverse physical outcomes such as cardiovascular disease and metabolic disorders, as well as mental health symptoms [13].

Because these dimensions of sleep capture different aspects of sleep health, a multimodal approach to assessment is critical for obtaining a comprehensive understanding of sleep behavior. While it is known that subjective and objective sleep measures often show discordance, this discrepancy itself offers valuable insights. Subjective measures reflect individuals' perceptions of their sleep, which may be influenced by psychological states such as anxiety, depression, or PTSD. In contrast, objective measures provide a direct assessment of physiological processes, highlighting the need to understand how these two perspectives align or diverge in populations exposed to IPV. This focus is particularly relevant given evidence suggesting that discordance between these measures may indicate specific psychological or behavioral disturbances, such as heightened arousal or misperception of sleep. By examining both subjective and objective sleep measures in IPV-exposed pregnant women, the present study aims to clarify the nature of these discrepancies and their implications for mental health and overall well-being.

Pregnancy is characterized by substantial changes in sleep patterns, with a majority of expectant women reporting insufficient and disrupted sleep [14]. Specifically, inadequate sleep duration and poor sleep quality during pregnancy have been associated with increased risk of preterm birth, gestational diabetes, prolonged labor, cesarean delivery, and hypertensive disorders, including preeclampsia [10, 13]. Sleep disturbances, such as insomnia and frequent nighttime awakenings, have also been linked to impaired immune function, heightened inflammation, and adverse mental health outcomes, including prenatal and postpartum depression [10]. Furthermore, objective sleep measures reveal that pregnant women exhibit lower sleep efficiency, increased frequency and duration of nighttime awakenings, and a greater amount of time in light sleep stages (e.g., Stage N2 sleep) compared to deep sleep and rapid eye movement (REM) sleep, which are crucial for cognitive restoration and emotional regulation [15].

IPV is a multifaceted phenomenon encompassing various subtypes, including physical violence, psychological aggression, and sexual coercion, each of which may exert unique effects on sleep. Physical violence may directly disrupt sleep through the physical consequences of injury or chronic pain, which are well-documented predictors of poor sleep quality and efficiency [16]. Psychological aggression, on the other hand, often fosters hypervigilance, rumination, and intrusive thoughts, which are strongly associated with sleep onset difficulties and fragmented sleep [17]. Sexual coercion is uniquely linked to sleep disturbances through the heightened risk of fear, hyperarousal, and avoidance behaviors, which condition survivors to associate sleep with vulnerability and danger [18]. Although these subtypes of IPV are often comorbid, understanding their distinct effects on sleep can illuminate targeted intervention strategies to mitigate their unique impacts.

Thus, sleep health is particularly relevant to examine in the context of IPV and pregnancy, as poor sleep quality is pervasive among both pregnant women and individuals exposed to IPV [19]. Accumulating evidence suggests that IPV victims frequently experience both self-reported and objective sleep disturbances [19]. High rates of poor sleep are evident in both population-based and IPV-exposed samples. Notably, in a large population-based survey, 53% of women exposed to physical violence reported difficulty getting adequate sleep compared to non-exposed counterparts [20]. Similarly, among those experiencing physical violence, 87.8% endorsed sleep disturbances, with history of IPV associated with a fourfold increase in self-reported sleep difficulties [21].

Although existing literature provides an important basis for work on IPV and sleep, few studies explore the intersection of IPV, mental health, and sleep quality in pregnancy. Further, existing research on IPV and sleep predominantly focuses on physical IPV, neglecting the impact of other IPV subtypes, such as psychological aggression and sexual coercion. Additionally, most studies have only used a single

method of assessing sleep, with few studies examining associations across both objective and subjective measures of sleep. The present study builds upon this gap by examining the concordance between subjective and objective sleep measures, exploring how IPV subtypes and mental health symptoms may differentially impact these dimensions of sleep. This focus allows for a more nuanced understanding of the biobehavioral mechanisms through which IPV affects sleep during pregnancy.

1.1 The current study

The present study sought to investigate the empirical links between IPV, PTSS, depressive, and anxiety symptoms, and disparities between self-reported and objective sleep quality in a sample of pregnant women. Specifically, we aimed to evaluate the connection between objective (actigraphy) and self-reported (PSQI) sleep metrics within our sample. First, we assessed the concordance between self-reported and objective measures of sleep. Second, we examined the associations between IPV subtypes, mental health symptoms, and both self-reported and objective sleep quality. Finally, we investigated the potential mediating roles of PTSS, depression, and anxiety in the links between IPV subtypes and both self-reported and objective sleep parameters. By integrating these analyses, the study aimed to elucidate the multifaceted pathways through which IPV and mental health intersect to influence sleep during pregnancy.

2 Method

2.1 Participants

A sample of n = 46 pregnant women (*Range* = 6–36 weeks; *M* = 22.79, *SD* = 8.37) were drawn from a longitudinal study of pregnant women and young families. Participants ranged in age from 19 to 42, with an average age of 27.6 years. The sample had a diverse composition, with 19 (41.3%) women identifying as Black, African, or African-American, 19 (41.3%) identifying as non-Hispanic White or Caucasian, 5 (10.9%) identifying as biracial or multiracial, and 3 (6.5%) identifying as another racial/ethnic background. The sample was overall low-income with an average income of $1349.71 per month (*SD* = 1137.37). Regarding educational attainment, the highest proportion of women (63.0%) reported some college or vocational degree, followed by 21.7% reporting high school degree/GED and 15.3% reporting some high school.

2.2 Procedures

Participants were recruited from the community primarily using flyers posted at local agencies and community centers. Participants in the current study were drawn from a larger study of women who had experienced IPV within the previous 24 months (or no IPV for participants serving as healthy controls), were in the first or second trimester of pregnancy, and planned to assume the role of primary caregiver for their infant postpartum. Upon obtaining written consent, participants completed an interview assessing experiences of violence in the past year, self-reported sleep quality, and mental health. Women who reported not cohabitating with a violent partner were invited to participate in a seven-day sleep actigraphy study. Participants who enrolled in the actigraphy study received brief training on the proper use of the actigraph watch and the completion of a daily sleep. After one week, a project coordinator retrieved the actigraph watch and sleep log from each participant at a location agreed upon in advance.

2.3 Measures

Demographics. Participants completed a brief demographics questionnaire to gather information on age, educational attainment, racial/ethnic background, and income (see Table 1 for summary).

Past year IPV victimization. Women's exposure to past year IPV was assessed using the Conflict Tactics Scale-Revised (CTS2) [22]. The CTS2 is a 78-item self-report measure that assesses psychological, sexual, and physical acts of violence experienced with a romantic partner in the past year; the present study used 39 items assessing IPV victimization. Participants rated the frequency of each item on a scale from 0 (never) to 6 (more than 20 times) using the frequency scoring procedure, which represents how often a particular behavior has occurred by taking the midpoint for each response (e.g., score of "4" for a behavior that occurred 3–5 times) with higher values reflecting greater violence exposure [22]. CTS2 has strong psychometric properties [23] and demonstrated adequate internal consistency in this study ($\alpha = 0.95$ for total, 0.90 for physical assault, 0.93 for psychological aggression, and 0.89 for sexual coercion).

Depressed mood. Depressed mood was assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) [24] a 20-item self-report assessment designed to measure emotional and behavioral symptoms. For each item, participants indicated the frequency of depressive symptoms in the past week on a scale of 0 (rarely or none of the time) to 3 (most or all of the time). Total scores reflect the severity of depressive symptoms, with scores of 16 or higher indicating clinical significance. The CES-D demonstrates high

Table 1 Demographic characteristics of participants

	Mean (SD)	n	%
Age	27.6	46	
Min		19	
Max		42	
Marital status			
Single (never married)		20	43.5
Living with partner		8	17.4
Married		10	21.7
Separated		6	13.0
Divorced		2	4.3
Employment status			
Employed		16	34.8
Not employed		30	65.2
Gestation (Weeks)		22.8	
Min		6	
Max		36	
Highest education level			
Some high school or less		7	15.2
High school degree/GED		10	21.7
Some college or vocational school (Associates degree)		19	41.3
College degree		9	19.6
Graduate degree		1	2.2
Race/Ethnicity			
Black/African/African-American		19	41.3
White/Caucasian		19	41.3
Biracial/Multiracial/Other		8	17.4

internal consistency, retest reliability, and validity [24]. The Cronbach's alpha for the present study was 0.88.

Anxiety. Anxiety was assessed with the Generalized Anxiety Disorder 7 scale (GAD-7) [25]. Total scores range from 0 to 21, with higher scores reflecting greater anxiety severity. Scores above 10 are considered to be clinically significant. GAD-7 demonstrates good reliability and internal consistency [26], with $\alpha = 0.85$ in the present study.

Posttraumatic stress symptoms (PTSS). PTSS were assessed using the PTSD Checklist for DSM–5 (PCL-5) [27]. a 20-item scale assessing symptom frequency in reexperiencing hyperarousal, negative mood and cognition, and avoidance domains within the past month on a scale of 0–4 (0 = not at all, 4 = extremely). Responses were summed for a total symptom severity score. The PCL-5 exhibits strong reliability and validity in psychometric evaluations [28] with $\alpha = 0.93$ in the present study.

Self-reported sleep. Self-reported sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI) [11]. The PSQI is a 19-item questionnaire evaluating sleep impairment in the past month. The PSQI generates a global score (0–21) and subscores in seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction). Each domain is scored from 0 to 3, with higher scores indicating greater dysfunction. The global score is calculated by summing the component scores. The original validation suggested a cut off score of ≥ 5 to differentiate between good and poor sleepers [11]. The PSQI has demonstrated good internal and test–retest reliability in previous studies [29] and had $\alpha = 0.74$ in the present study. Descriptive statistics for women's prenatal sleep quality assessed by the PSQI are presented in Table 3.

Objectively measured sleep. Objective sleep characteristics were monitored using an Actiwatch worn on the non-dominant wrist for seven consecutive days following the interview. Actigraphy is a reliable and valid tool, and comparisons with PSG has typically yielded agreement rates between 78–95% [30]. Data were recorded in 30-s epochs and processed and scored using the "Cole-Kripke" algorithm [31] in the "Action-W" software. Participants received both verbal and written instructions on the proper use of the device, including how and when to wear it. Concurrently, women completed a sleep diary documenting bedtimes, rise times, and device removal. This information was combined with the actigraphy data, and used to detect and remove

Table 2 Bland Altman analysis: Comparison of self-reported and objective sleep

Sleep parameters	Actigraphy (A) (mean ± SD)	PSQI (B) (mean ± SD)	Mean ((A + B)/2))	Difference (A – B)	Spearman's rank correlation
TIB (min)	501.06 ± 63.34	529.67 ± 81.40	515.37	−28.61	0.369*
SOL (min)	10.88 ± 22.85	39.54 ± 38.68	25.21	−28.66	−0.311*
TST (min)	420.60 ± 87.65	424.09 ± 111.99	422.35	−3.49	0.178
SE (%)	83.88 ± 14.14	81.09 ± 21.10	82.49	2.79	0.059
Mean ($\bar{d}$)				−15.89	

*$p < .05$

artifacts from the data to facilitate scoring and interpretation. The following sleep measures were derived: time in bed (TIB), total sleep time (TST), sleep onset latency (SOL), and sleep efficiency (SE). Daily values of sleep variables were averaged to obtain mean scores for the week. A summary of key terms and definitions can be seen in Supplement 1.

2.4 Analytic Plan

The agreement of the four sleep indicators (TIB, TST, SOL, and SE) between self-reported (PSQI) and objective (actigraphy) measures were tested using Spearman's rank test for correlation, two-tailed paired t-tests to calculate difference from 0, and the Bland–Altman technique [32]. The Bland–Altman approach involves a scatterplot with the X-axis depicting the mean of the measurements, and the Y-axis representing the difference of two measurements. Using IBM SPSS 29, a one-sample *t* test was performed to calculate the mean bias and its standard deviation (SD). Mean difference and SD obtained from the *t* test were used to compute the mean bias and limits of agreement (LoAs), restricting data points to a mean difference ± 1.96 SD to show a 95% confidence interval (see Table 2). Perfect agreement is achieved when there is no difference between measurements (i.e., mean difference is zero). Finally, plots were examined for proportional bias using ordinary least squares regression, where a significant slope in the regression line fitted to the plot indicates proportional bias [33]. The statistical significance level was set at $p < 0.05$ for all analyses.

Associations between IPV and self-reported and objective sleep quality were analyzed in Stata 16.0 (StataCorp, 2019) using path analysis (see Tables 4 and 5). IPV subtypes were entered as independent variables (IVs), mental health variables (depression, anxiety, and PTSS) as a mediator(s), and sleep characteristics (TIB, TST, SOL, and SE) as dependent variables (DVs). Self-reported sleep data, collected concurrently with IPV and mental health reports, were assessed cross-sectionally. This type of mediation does not address the direction of these relationships and therefore does not warrant a strong conclusion about whether IPV or mental health symptoms lead to subsequent subjective sleep outcomes. Data on objective sleep, however, was collected prospectively across the 7 days following interviews. As such, models examining objective sleep were prospective and inferences concerning direction are more appropriate to consider; however, care must still be exercised in drawing inferences (Table 3). See Fig. 1 for an illustration of the mediation pathways.

Given the high correlations among mental health dimensions, separate mediation models were used to avoid incorrect suppressing of direct and/or indirect effects [34]. Total, direct, and indirect effects were examined for each IV (physical violence, psychological aggression, sexual coercion) on the DV (self-reported and objective sleep). Age and gestational age were entered as covariates in all models due to past research linking them to sleep difficulties [35]. It is important to note that both mediation models were considered exploratory, given the small sample size, making them underpowered to detect anything except large indirect effects [40].

There were no instances of missing data regarding the objective sleep parameters. However, there were three individuals with missing data on the PSQI. The missing data did not correspond with differences in mental health across all three variables or sexual coercion; however, those missing PSQI data reported elevated levels of psychological aggression and physical assault. These findings suggest the data were missing at random, a type of missingness that can be considered ignorable. Full information maximum likelihood was therefore deemed an appropriate technique for handling missingness under such conditions [41].

3 Results

3.1 Self-Reported and Objective Sleep Metrics

Results from the PSQI indicated a mean TIB of 529.67 min (i.e., 8.83 h/night; *SD* = 81.40 min), mean TST of 424.09 min (i.e., 7.07 h/night; *SD* = 111.99), mean SOL of 39.54 min (*SD* = 38.68), and mean SE of 81.09% (*SD* = 21.10%). The

Table 3 Descriptives of women's prenatal sleep quality measured using PSQI

Characteristic	Category	N	Mean	SD	%
Sleep quality		46	1.37	0.68	
	Very good	2			4.30
	Good	28			60.90
	Poor	13			28.30
	Very poor	3			6.50
Sleep latency		45	39.54	38.68	
	< 15 min	5			11.10
	16–30 min	16			35.60
	31–60 min	15			33.30
	> 60 min	9			20.00
Sleep duration		46	7.06	1.86	
	> 7 h	31			84.80
	6–7 h	8			10.90
	5–6 h	5			2.20
	< 5 h	2			2.20
Sleep efficiency		44	81.09	21.10	
	> 85%	22			50.00
	75–84%	9			20.50
	65–74%	4			9.10
	< 65%	9			20.50
Sleep disturbances		45	1.46	0.55	
	Not during the past month	1			2.20
	< Once/week	23			50.0
	Once or twice/week	22			47.80
	3 + times/week	0			0
Sleep medication		46	0.22	0.59	
	Not during the past month	39			84.80
	< Once/week	5			10.90
	Once or twice/week	1			2.20
	3 + times/week	1			2.20
Daytime dysfunction		45	1.15	0.71	
	0	6			13.30
	1	28			62.20
	2	9			20.00
	3	2			4.40
Global PSQI score		43	7.65	2.96	
	Good sleep quality (< 5)	11			25.58
	Poor sleep quality (≥ 5)	32			74.42

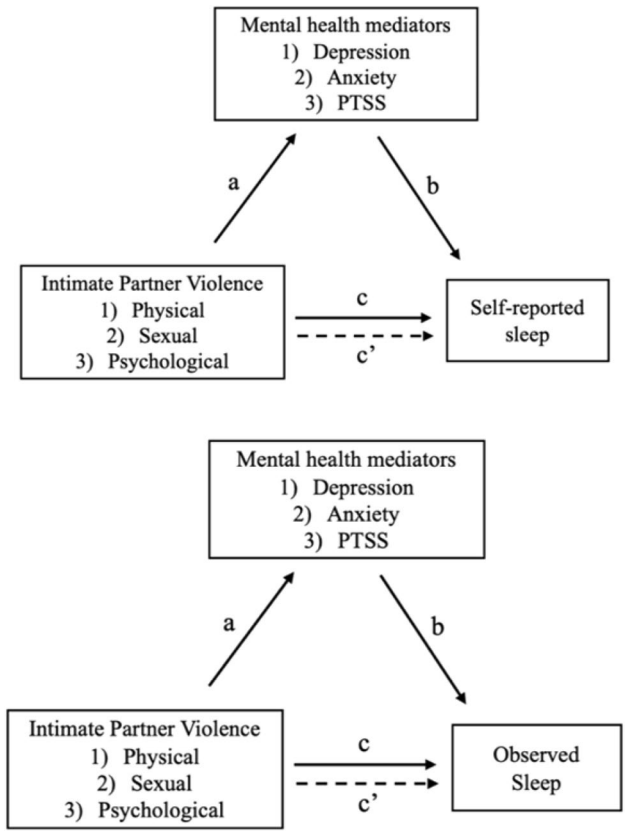

Fig. 1 Cross-sectional (above) and Prospective (below) Mediation Pathways

average PSQI global score was 7.65 ($SD = 2.96$). On average, women qualitatively described their overall sleep quality as "good"; however, around 70% of the sample exceeded the PSQI global score cutoff of five, indicating prevalent "poor" sleep quality. Objectively, actigraphy revealed mean TIB of 501.06 min (i.e., 8.35 h/night; $SD = 63.34$ min), mean TST of 420.60 min (i.e., 7.01 h/night; $SD = 87.65$ min), mean SOL of 10.88 min ($SD = 22.85$ min), and mean SE of 83.88% ($SD = 14.14\%$) (Table 4).

3.2 Agreement Between Actigraphy and PSQI

Concordance analyses revealed significant, moderate correlations between self-reported and objective measures for TIB ($r = 0.37$, $p = 0.013$) and SOL ($r = -0.31$, $p = 0.038$). However, no significant correlations were found for TST or SE. Bland–Altman analyses highlighted a lack of concordance between measures for TIB and SOL, with PSQI overestimating TIB by 27.93 min and SOL by 28.50 min. Proportional bias was evident for SOL and SE, suggesting the degree of overestimation varied depending on the parameter's magnitude (see Fig. 2).

3.3 Sleep Outcomes

Time in Bed (TIB). For TIB, the PSQI and actigraphy were moderately correlated ($r = 0.37$, $p = 0.013$), but Bland–Altman analyses revealed that PSQI overestimated TIB by an average of 27.93 min (LoA: -189.47 min to 133.61 min). There were no significant associations between IPV subtypes or mental health variables and TIB in either self-reported or objective measures (Table 5).

Total Sleep Time (TST). For TST, no significant correlation was observed between the PSQI and actigraphy ($t = -0.10$, $p = 0.920$). However, objective TST was negatively associated with physical violence in the models examining anxiety ($\beta = -0.06$, $p = 0.036$, 95% CI [-0.119, -0.004]) and depression ($\beta = -0.06$, $p = 0.039$, 95% CI [-0.112, -0.003]). No significant effects were observed for psychological aggression or sexual coercion.

Sleep Onset Latency (SOL). For SOL, PSQI and actigraphy showed a significant but inverse correlation ($r = -0.31$, $p = 0.038$), with PSQI overestimating SOL by 28.50 min on average (LoA: -121.13 min to 64.13 min). Sexual coercion consistently exhibited direct effects on self-reported SOL, controlling for anxiety ($\beta = -0.31$, $p = 0.003$, 95% CI [-0.518, -0.105]), depression ($\beta = -0.30$, $p = 0.002$, 95% CI [-0.490, -0.107]), and PTSS ($\beta = -0.28$, $p = 0.007$, 95% CI [-0.485, -0.076]). Physical violence showed direct effects on objective SOL, particularly when controlling for anxiety ($\beta = 0.16$, $p = 0.046$, 95% CI [0.003, 0.318]) and PTSS ($\beta = 0.20$, $p = 0.019$, 95% CI [0.032, 0.359]). Additionally, psychological aggression was directly associated with objective SOL when controlling for PTSS ($\beta = 0.17$, $p = 0.028$, 95% CI [0.018, 0.314]).

Sleep Efficiency (SE). For SE, PSQI underestimated objective SE by 2.85% on average (LoA: -47.72% to 53.42%). Significant proportional bias was observed ($\beta = -0.73$, $R^2 = 0.13$, $p = 0.016$). Objective SE was directly impacted by physical violence in models for anxiety ($\beta = -0.07$, $p = 0.003$, 95% CI [-0.113, -0.023]) and depression ($\beta = -0.06$, $p = 0.005$, 95% CI [-0.108, -0.019]). Additionally, psychological aggression negatively affected SE in anxiety models ($\beta = -0.05$, $p = 0.018$, 95% CI [-0.098, -0.009]). No significant effects were observed for self-reported SE.

4 Summary of Mediation Analyses

Across all models, no significant indirect (mediated) effects were found. Direct effects were the most prominent, with psychological aggression and sexual coercion consistently impacting SOL, and physical violence influencing TST and SE. These findings underscore the unique contributions of IPV subtypes to specific dimensions of sleep.

Table 4 Path analysis examining associations between IPV, mental health and self-reported sleep

IV	M	DV	Direct effect coefficient	SE	Z	P	95% CI
Direct effects							
Physical IPV	Anxiety	SR TST	−0.03	0.04	-0.61	.541	-0.106, 0.055
		SR TIB	-0.03	0.02	-1.49	.137	-0.061, 0.008
		SR SOL	-0.07	0.09	-0.72	.472	-0.021, 0.035
		SR SE	0.00	0.04	0.07	.942	-0.080, 0.087
Psychological IPV	Anxiety	SR TST	0.01	0.04	0.20	.838	-0.063, 0.078
		SR TIB	-0.02	0.02	-0.93	.352	-0.049, 0.018
		SR SOL	-0.14	0.08	-1.65	.100	-0.301, 0.026
		SR SE	0.02	0.04	0.64	.524	−0.048, 0.093
Sexual IPV	Anxiety	SR TST	−0.04	0.05	−0.76	.449	−0.134, 0.059
		SR TIB	−0.03	0.02	−1.13	.258	−0.073, 0.019
		SR SOL	−0.31	0.11	−2.96	.003**	−0.518, −0.105
		SR SE	−0.02	0.05	−0.30	.766	−0.114, 0.084
Physical IPV	Depression	SR TST	−0.02	0.05	−0.50	.620	−0.115, 0.068
		SR TIB	−0.03	0.02	−1.59	.111	−0.063, 0.007
		SR SOL	−0.08	0.09	−0.92	.359	−0.257, 0.093
		SR SE	0.01	0.05	0.16	.877	−0.087, 0.103
Psychological IPV	Depression	SR TST	0.01	0.04	0.14	.890	−0.077, 0.089
		SR TIB	−0.02	0.02	−1.03	.304	−0.051, 0.016
		SR SOL	−0.17	0.08	−2.21	.027*	−0.330, −0.020
		SR SE	0.02	0.04	0.53	.597	−0.062, 0.108
Sexual IPV	Depression	SR TST	−0.05	0.05	−1.09	.276	−0.142, 0.041
		SR TIB	−0.02	0.02	−0.93	.354	−0.063, 0.023
		SR SOL	−0.30	0.10	−3.05	.002**	−0.49, −0.107
		SR SE	−0.03	0.05	−0.71	.477	−0.130, 0.061
Physical IPV	PTSS	SR TST	−0.03	0.05	−0.68	.495	−0.120, 0.058
		SR TIB	−0.03	0.02	−1.43	.152	−0.063, 0.010
		SR SOL	−0.05	0.10	−0.55	.584	−0.245, 0.138
		SR SE	−0.00	0.05	−0.05	.964	−0.095, 0.091
Psychological	**PTSS**	**SR TST**	**−0.02**	**0.04**	**−0.36**	**.717**	**−0.097, 0.067**
		SR TIB	−0.01	0.02	−0.71	.475	−0.049, 0.023
		SR SOL	−0.13	0.09	−1.45	.148	−0.315, 0.047
		SR SE	−0.00	0.04	−0.05	.961	−0.086, 0.082
Sexual IPV	PTSS	SR TST	−0.06	0.05	−1.23	.218	−0.153, 0.035
		SR TIB	−0.02	0.02	−0.77	.442	−0.062, 0.027
		SR SOL	−0.28	0.10	−2.69	.007**	−0.485, −0.076

Table 4 (continued)

IV	M	DV	Direct effect coefficient	SE	Z	P	95% CI
		SR SE	−0.05	0.05	−0.92	.358	−0.144, 0.052
Indirect effects							
Physical IPV	Anxiety	SR TST	−0.01	0.01	−0.88	.377	−0.040, 0.015
		SR TIB	0.00	0.00	0.60	.546	−0.001, 0.002
		SR SOL	0.02	0.02	0.72	.470	−0.028, 0.061
		SR SE	−0.01	0.02	−0.91	.361	−0.045, 0.016
Psychological IPV	Anxiety	SR TST	−0.03	0.02	−1.53	.126	−0.060, 0.007
		SR TIB	0.00	0.00	0.66	.512	−0.008, 0.016
		SR SOL	0.05	0.04	1.29	.198	−0.024, 0.118
		SR SE	−0.03	0.02	−1.67	.094	−0.066, 0.005
Sexual IPV	Anxiety	SR TST	−0.02	0.02	−1.15	.249	−0.065, 0.017
		SR TIB	0.01	0.01	0.73	.464	−0.010, 0.022
		SR SOL	0.06	0.04	1.39	.166	−0.026, 0.149
		SR SE	−0.03	0.02	−1.32	.187	−0.074, 0.015
Physical IPV	Depression	SR TST	−0.01	0.02	−0.71	.478	−0.046, 0.021
		SR TIB	0.00	0.00	0.54	.592	−0.006, 0.010
		SR SOL	0.04	0.04	1.04	.299	−0.034, 0.110
		SR SE	−0.01	0.02	−0.76	.446	−0.052, 0.023
Psychological IPV	Depression	SR TST	−0.03	0.02	−1.06	.289	−0.073, 0.022
		SR TIB	0.00	0.01	0.72	.474	−0.008, 0.017
		SR SOL	0.09	0.05	1.88	.060	−0.004, 0.174
		SR SE	−0.03	0.03	−1.16	.244	−0.082, 0.021
Sexual IPV	Depression	SR TST	−0.01	0.02	−0.68	.499	−0.049, 0.024
		SR TIB	0.00	0.00	0.40	.687	−0.007, 0.010
		SR SOL	0.05	0.05	0.97	.334	−0.048, 0.142
		SR SE	−0.01	0.02	−0.70	.486	−0.054, 0.026
Physical IPV	PTSS	SR TST	−0.01	0.02	−0.47	.641	−0.037, 0.023
		SR TIB	0.00	0.01	0.00	.996	−0.011, 0.011
		SR SOL	0.01	0.03	0.35	.728	−0.054, 0.077
		SR SE	−0.01	0.02	−0.49	.625	−0.039, 0.023
Psychological	PTSS	SR TST	−0.01	0.02	−0.35	.723	−0.050, 0.035
		SR TIB	0.00	0.01	0.02	.983	−0.016, 0.017
		SR SOL	0.05	0.05	0.99	.325	−0.047, 0.141
		SR SE	−0.01	0.02	−0.37	.711	−0.053, 0.036
Sexual IPV	PTSS	SR TST	−0.00	0.02	−0.32	.752	−0.035, 0.025
		SR TIB	−0.00	0.01	−0.25	.806	−0.013, 0.010

Table 4 (continued)

IV	M	DV	Direct effect	coefficient	SE	Z	P	95% CI
		SR SOL	0.03		0.03	0.89	.373	−0.036, 0.095
		SR SE	−0.00		0.02	−0.22	.827	−0.035, 0.028

5 Discussion

The primary objectives of this study were twofold. First, we aimed to explore the agreement between self-reported and objective sleep measures in pregnant women, encompassing parameters such as time in bed, total sleep time, sleep onset latency, and sleep efficiency. Second, we sought to analyze the mediating effects of mental health (anxiety, depression, and PTSS) in the association between IPV and sleep. Recent studies underscore the significant impact of interpersonal conflicts on sleep outcomes [19]. Our findings extend this literature by highlighting mediating role of mental health symptoms in the context of IPV victimization and its effects on both self-reported and objective sleep measures. By elucidating specific IPV subtypes and distinct domains of sleep, our findings make a novel contribution to the body of research on risk factors related to maternal mental health and sleep during the perinatal period.

This study's use of both subjective and objective sleep measures addresses a significant gap in the literature on IPV and sleep, as many studies rely exclusively on one method. While previous work has demonstrated the value of combining these approaches, our findings underscore their utility in capturing a more comprehensive picture of sleep behaviors among IPV-exposed pregnant women. Specifically, although individuals demonstrated a reasonable ability to estimate their total sleep time and sleep efficiency, discrepancies were noted in self-assessments of time in bed and sleep onset latency. These findings are consistent with existing literature [36, 37] which indicates that subjective perceptions may not fully align with objective data for complex sleep processes like sleep onset. By integrating both types of measures, this study provides a more nuanced understanding of sleep, which is often overlooked in IPV research.

The second aim of this study was to evaluate the relations among IPV exposure, mental health, and sleep. In the mediation models examining self-reported sleep parameters, significant associations emerged among IPV and multiple dimensions of mental health symptoms. Further, sexual coercion exhibited a significant direct effect on sleep onset latency when controlling for anxiety, while psychological and sexual IPV demonstrated direct effects on sleep onset latency even controlling for depression. Likewise, sexual IPV demonstrated a significant direct effect on sleep onset latency when controlling for PTSS.

In models examining objective sleep parameters, results additionally revealed a significant direct effect of physical violence on total sleep time, sleep onset latency, and sleep efficiency, as well as a significant direct effect of psychological aggression on sleep efficiency when controlling for anxiety. Likewise, when depression served as a mediator, significant direct effects were evident, such as physical violence

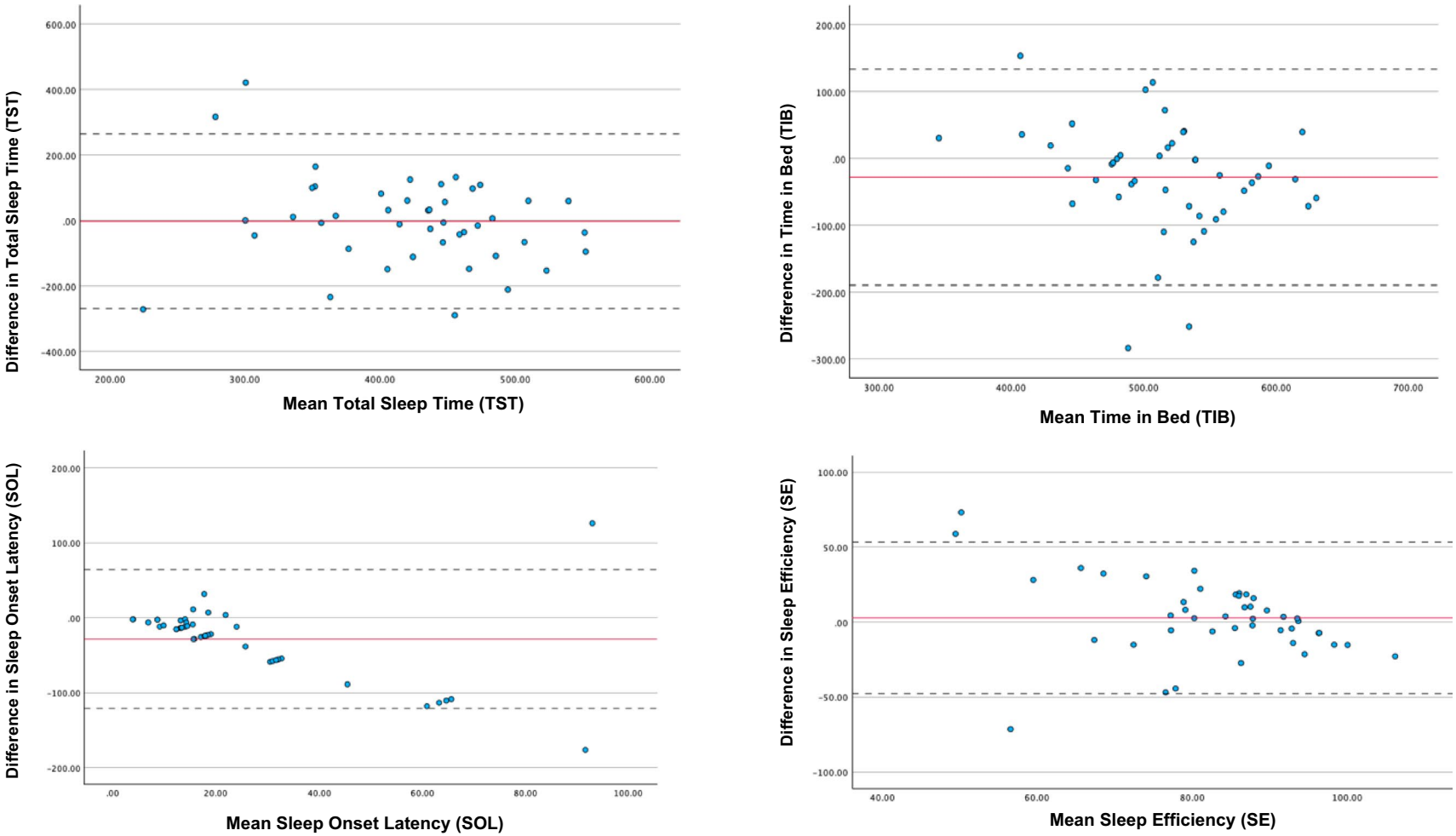

Fig. 2 Bland Altman plots for TST, TIB, SOL, SE. *Note.* The x-axes represent the mean of the values derived from sleep parameters ([actigraphy + PSQI] / 2), and the y-axes represent the difference of between actigraphy and PSQI derived sleep parameters (Actigraphy - PSQI). Negative values indicate an overestimation by PSQI relative to actigraphy, and positive values indicate an underestimation by PSQI relative to actigraphy. The solid horizontal lines (red) indicate the mean bias, and broken lines (grey) indicate the 95% limits of agreement ($\pm$ 1.96 $\times$ SD)

Table 5 Path analysis examining associations between IPV, mental health and objective sleep

IV	M	DV	Direct effect coefficient	SE	Z	P	95% CI
Direct effects							
Physical IPV	Anxiety	TST	−0.06	0.03	−2.10	.036*	−0.119, 0.004
		TIB	0.01	0.01	0.60	.551	−0.019, 0.035
		SOL	0.16	0.08	2.00	.046*	0.003, 0.318
		SE	−0.07	0.02	−2.94	.003**	−0.113, −0.023
Psychological IPV	Anxiety	TST	−0.04	0.03	−1.53	.127	−0.101, 0.013
		TIB	0.01	0.01	0.88	.380	−0.013, 0.034
		SOL	0.10	0.07	1.34	.181	−0.046, 0.243
		SE	−0.05	0.02	−2.36	.018*	−0.098, −0.009
Sexual IPV	Anxiety	TST	−0.01	0.04	−0.29	.770	−0.095, 0.071
		TIB	0.01	0.02	0.34	.736	−0.027, 0.038
		SOL	0.19	0.10	1.91	.057	−0.005, 0.391
		SE	−0.02	0.04	−0.53	.597	−0.089, 0.051
Physical IPV	Depression	TST	−0.06	0.03	−2.07	.039*	−0.112, −0.003
		TIB	0.01	0.01	0.54	.589	−0.019, 0.034
		SOL	0.17,	0.08	2.05	.040*	0.007, 0.328
		SE	−0.06	0.02	−2.78	.005**	−0.108, −0.019
Psychological IPV	Depression	TST	−0.03	0.03	−1.32	.186	−0.084, 0.016
		TIB	0.01	0.01	0.73	.468	−0.015, 0.032
		SOL	0.13	0.07	1.74	.082	−0.016, 0.267
		SE	−0.04	0.02	−1.93	.053	−0.083, 0.001
Sexual IPV	Depression	TST	−0.01	0.03	−0.36	.722	−0.080, 0.056
		TIB	−0.00	0.02	−0.19	.848	−0.034, 0.028
		SOL	0.21	0.09	2.24	.025*	0.026, 0.390
		SE	−0.01	0.03	−0.31	.755	−0.067, 0.049
Physical IPV	PTSS	TST	−0.05	0.03	−1.81	.071	−0.111, 0.005
		TIB	0.01	0.01	0.46	.642	−0.022, 0.035
		SOL	0.20	0.08	2.35	.019*	0.032, 0.359
		SE	−0.06	0.02	−2.51	.012*	−0.107, −0.013
Psychological IPV	PTSS	TST	−0.03	0.03	−1.20	.231	−0.088, 0.021
		TIB	0.00	0.01	0.36	.719	−0.021, 0.030
		SOL	0.17	0.08	2.20	.028*	0.018, 0.314
		SE	−0.04	0.02	−1.69	.091	−0.083, 0.006
Sexual IPV	PTSS	TST	−0.00	0.04	−0.08	.934	−0.074, 0.068
		TIB	−0.00	0.02	−0.29	.770	−0.038, 0.028
		SOL	0.24	0.09	2.56	.010*	0.057, 0.427

Table 5 (continued)

IV	M	DV	Direct effect coefficient	SE	Z	P	95% CI
		SE	0.00	0.03	0.01	.994	−0.059, 0.060
Indirect effects							
Physical IPV	Anxiety	TST	−0.00	0.01	−0.26	.792	−0.016, 0.012
		TIB	−0.00	0.01	−0.57	.566	−0.135, 0.007
		SOL	0.01	0.01	0.49	.624	−0.018, 0.030
		SE	0.00	0.00	0.39	.698	−0.007, 0.010
Psychological IPV	Anxiety	TST	−0.00	0.02	−0.13	.896	−0.032, 0.028
		TIB	−0.01	0.01	−1.40	.162	−0.022, 0.004
		SOL	0.01	0.02	0.38	.705	−0.039, 0.058
		SE	0.01	0.01	0.69	.489	−0.015, 0.031
Sexual IPV	Anxiety	TST	−0.01	0.02	−0.32	.752	−0.053, 0.038
		TIB	−0.01	0.01	−1.47	.141	−0.027, 0.004
		SOL	0.01	0.03	0.17	.862	−0.061, 0.073
		SE	0.01	0.02	0.29	.772	−0.038, 0.046
Physical IPV	Depression	TST	−0.01	0.01	−0.67	.505	−0.022, 0.011
		TIB	−0.00	0.00	−0.65	.515	−0.010, 0.005
		SOL	−0.00	0.01	−0.38	.702	−0.023, 0.015
		SE	−0.00	0.00	−0.60	.545	−0.012, 0.006
Psychological IPV	Depression	TST	−0.01	0.01	−1.22	.224	−0.032, 0.008
		TIB	−0.01	0.01	−1.41	.159	−0.017, 0.003
		SOL	−0.02	0.02	−0.75	.452	−0.067, 0.030
		SE	−0.00	0.01	−0.58	.560	−0.019, 0.010
Sexual IPV	Depression	TST	−0.01	0.01	−0.68	.499	−0.029, 0.014
		TIB	−0.00	0.00	−0.66	.509	−0.011, 0.006
		SOL	−0.00	0.01	−0.39	.695	−0.029, 0.019
		SE	−0.00	0.01	−0.63	.532	−0.018, 0.009
Physical IPV	PTSS	TST	−0.01	0.01	−1.00	.315	−0.030, 0.010
		TIB	−0.00	0.00	−0.42	.677	−0.010, 0.007
		SOL	−0.03	0.03	−1.16	.247	−0.087, 0.023
		SE	−0.01	0.01	−0.83	.408	−0.021, 0.009
Psychological IPV	PTSS	TST	−0.01	0.01	−0.96	.336	−0.040, 0.014
		TIB	−0.00	0.01	−0.48	.630	−0.015, 0.009
		SOL	−0.06	0.04	−1.48	.139	−0.130, 0.018
		SE	−0.01	0.01	−0.68	.497	−0.029, 0.014
Sexual IPV	PTSS	TST	−0.02	0.01	−1.25	.211	−0.044, 0.010
		TIB	−0.00	0.00	−0.18	.860	−0.011, 0.009

Table 5 (continued)

IV	M	DV	Direct effect coefficient	SE	Z	P	95% CI
		SOL	−0.04	0.03	−1.16	.247	−0.104, 0.027
		SE	−0.01	0.01	−1.22	.222	−0.036, 0.008

on total sleep time and sleep efficiency and sexual coercion on sleep onset latency. Finally, with PTSS as a mediator, the models elucidated a significant direct effect of physical violence on sleep onset latency and sleep efficiency; psychological aggression on sleep onset latency; and sexual coercion on sleep onset latency. No indirect effects were observed in any of the models.

In light of these robust direct effects and lack of significant indirect effects, our findings suggest that IPV may emerge as a *direct* predictor of sleep disturbances, above and beyond the role of mental health symptoms. Physical violence, in particular, consistently exhibited a significant direct effect on sleep efficiency. This association might be explained by the potential development of chronic pain as a mechanism linking physical abuse and decreased sleep efficiency. Previous research has established the correlation between physical violence and chronic pain, which, in turn, has been linked to disrupted sleep patterns, including decreased sleep efficiency [16]. Additionally, research has indicated a correlation between the increased intensity of physical assaults and a reduction in sleep duration [38]. This relationship may also stem from the persistent stimulation of the hypothalamic–pituitary–adrenal (HPA) axis, which is activated in response to the continuous fear stemming from various forms of abuse, including physical, sexual, and verbal [39].

Our results underscore the significant impact of sexual coercion on sleep onset latency, suggesting that direct consequences of sexual IPV may contribute to heightened difficulties in falling asleep. This finding was replicated across both objective and self-reported sleep, despite a moderate level of disagreement between these two measures on sleep onset latency. While self-reported and objective sleep onset latency may diverge, they demonstrate concurrent validity in the context of sexual IPV. This relationship may be explained by experiences of sexual violence leading to heightened nondisclosure and intrusive thoughts, subsequently increasing sleep latency. For instance, researchers found that exposure to violence was linked to constraints in sharing one's experiences, which, in turn, was associated with intrusive thoughts concerning the victimization experience [17]. Furthermore, survivors of sexual abuse often associate sleep with danger, perceiving it as a vulnerable state due to a lack of control over their surroundings [18]. This conditioned hyperarousal and hypervigilance may further disrupt sleep patterns.

Another potential mechanism linking IPV and sleep disturbances, not directly measured in this study, is fear of sleep. IPV survivors may experience conditioned hyperarousal and hypervigilance, perceiving sleep as a vulnerable state due to a lack of control over their surroundings. Fear of sleep, heightened by trauma, could further explain difficulties with sleep onset latency. For instance, researchers highlighted how survivors of sexual abuse often associate

sleep with danger, which may perpetuate disruptions in sleep patterns [18].

Findings from this study should be interpreted in light of several limitations. The lack of significant indirect effects on sleep via mental health was surprising. These findings may be attributable to several factors, including a small sample size or the presence of relatively mild mental health symptoms. The limited power in testing indirect effects is especially plausible as many models showed joint significance of the pathways (i.e., a➔b➔c). Considering the minimum sample size requirements for mediation outlined in literature (Sim et al., 2021), our models were underpowered to detect anything but very large direct effects. Future research should thus further investigate the potential roles of anxiety, depression, and PTSS symptoms in the link between IPV victimization and sleep with larger sample sizes. Additionally, the cross-sectional nature of models examining self-reported sleep precludes inferences about causation. Future work should focus on clarifying directionality of effects and exploring transactional relationships among the variables in the model. It will also be important to explore the broader social factors that may intersect with IPV, mental health, and sleep during pregnancy. Factors such as perceived familial and social support, employment challenges, and pregnancy intention (e.g., planned versus unplanned pregnancies) likely play a critical role in shaping maternal experiences and outcomes. Examining these variables could provide deeper insight into the ways structural and social determinants of health influence mental health and sleep quality in this population. Finally, given the sensitive nature of IPV, there is a potential for underreporting, as participants may have hesitated to disclose experiences fully despite assurances of confidentiality. Future research should address these limitations by incorporating larger, longitudinal samples and considering additional contextual and individual-level factors to better capture the complexity of these dynamics. The predominance of African American women in our sample underscores the importance of considering social determinants of health. African American women often encounter significant healthcare disparities during pregnancy, including systemic biases and limited access to prenatal care, which may exacerbate the impact of IPV on sleep. For instance, research indicates that Black women are more likely to experience late initiation of prenatal care [42] and are disproportionately affected by "maternity care deserts,", areas lacking hospitals offering obstetric care and OB/GYN or certified nurse midwife providers [43]. Future research should explore how such systemic inequities, coupled with the stress of IPV, can significantly disrupt sleep patterns among pregnant African American women.

A notable limitation of the present study is the absence of certain contextual and individual-level factors that may significantly influence the relationships between IPV, mental health, and sleep. Variables such as socioeconomic status, physical health, social support, and pregnancy preparedness, along with personal and social resources like personality, coping mechanisms, and family support, were not included in the analysis. Future research should consider incorporating these factors to provide a more comprehensive understanding of the complex interplay between IPV and maternal well-being. Further, different types and severities of IPV may have varying impacts on mental health and sleep outcomes, highlighting the importance of considering these distinctions. Although our study did not stratify findings based on specific IPV experiences, this may help better understand how diverse forms of IPV uniquely influence maternal well-being.

Our findings have significant implications for future research and clinical practice. Given the robust direct effects of IPV on sleep disturbances, independent of mental health symptoms, healthcare providers should prioritize routine screening for sleep problems in IPV-exposed pregnant women. Sleep disturbances are a modifiable risk factor with far-reaching consequences for both maternal and fetal health. Early identification and intervention can mitigate these risks. Integrating sleep assessments with mental health screenings as part of comprehensive prenatal care ensures a more holistic approach to patient well-being; for example, the use of both objective tools like actigraphy and subjective tools like sleep diaries could provide a nuanced understanding of sleep behaviors, highlighting discrepancies between perceived and actual sleep. This comprehensive assessment may also reveal specific patterns of sleep disruption linked to IPV, such as prolonged sleep latency or reduced sleep efficiency, guiding tailored interventions.

Healthcare providers should adopt trauma-informed care approaches that address the unique psychological and physiological challenges faced by IPV survivors. Such approaches include managing hyperarousal, intrusive thoughts, and hypervigilance, which are often key barriers to achieving restorative sleep. Additionally, incorporating psychoeducation on the connection between trauma and sleep can empower patients to recognize and address their sleep difficulties. Providing psychoeducation on sleep hygiene practices is another critical step in intervention. This education should be tailored to the specific needs of IPV-exposed women, taking into account the potential barriers they face, such as unsafe sleep environments or high levels of stress. Practical strategies like creating calming bedtime routines, minimizing exposure to environmental stressors, and establishing consistent sleep–wake cycles can promote better sleep outcomes. Collaboration with social workers or IPV advocates may further help address external stressors, such as unstable housing or safety concerns, that exacerbate sleep disturbances.

Future research should focus on elucidating the mechanisms underlying the observed direct effects of IPV on sleep. Specifically, longitudinal studies could help clarify how IPV subtypes (e.g., physical violence, psychological aggression, and sexual coercion) uniquely influence specific dimensions of sleep over time, such as latency, duration, and efficiency. Additionally, research should explore the interplay of systemic factors like socioeconomic stress and healthcare disparities in shaping sleep outcomes among IPV-exposed populations. Such work could inform targeted interventions aimed at addressing these broader determinants of health.

Finally, given the bidirectional relationship between sleep and mental health, interventions targeting sleep problems may also improve psychological outcomes in IPV survivors. For instance, addressing sleep disturbances may reduce symptoms of depression, anxiety, and posttraumatic stress, further enhancing overall well-being. Researchers and healthcare practitioners must continue to investigate how sleep-focused interventions can serve as an entry point for addressing the broader health needs of IPV-exposed pregnant women, ensuring both maternal and fetal health are prioritized.

Sufficient and high-quality sleep is paramount for maintaining both physical and psychological well-being [13]. Researchers and healthcare practitioners must continue to discern the underlying factors contributing to inadequate sleep, especially for pregnant women who have experienced violence.

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Data availability Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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References

1. Breiding, M., Basile, K. C., Smith, S. G., Black, M. C., & Mahendra, R. R. (2015). Intimate partner violence surveillance: Uniform definitions and recommended data elements. Version 2.0.
2. Thompson RS, Bonomi AE, Anderson M, Reid RJ, Dimer JA, Carrell D, Rivara FP. Intimate partner violence: prevalence, types, and chronicity in adult women. Am J Prev Med. 2006;30(6):447–57. https://doi.org/10.1016/j.amepre.2006.01.016.
3. Hahn CK, Gilmore AK, Aguayo RO, Rheingold AA. Perinatal intimate partner violence. Obstet Gynecol Clin North Am. 2018;45(3):535–47. https://doi.org/10.1016/j.ogc.2018.04.008.
4. Bjelica A, Cetkovic N, Trninic-Pjevic A, Mladenovic-Segedi L. The phenomenon of pregnancy — a psychological view. Ginekol Pol. 2018;89(2):102–6. https://doi.org/10.5603/gp.a2018.0017.
5. Beydoun HA, Beydoun MA, Kaufman JS, Lo B, Zonderman AB. Intimate partner violence against adult women and its association with major depressive disorder, depressive symptoms and postpartum depression: A systematic review and meta-analysis. Soc Sci Med. 2012;75(6):959–75. https://doi.org/10.1016/j.socscimed.2012.04.025.
6. El-Sheikh M, Kelly R, Rauer A. Quick to berate, slow to sleep: Interpartner psychological conflict, mental health, and sleep. Health Psychol : Official J Division Health Psychol, Am Psychol Association. 2013;32(10):1057–66. https://doi.org/10.1037/a0031786.
7. Kastello JC, Jacobsen KH, Gaffney KF, Kodadek MP, Bullock LC, Sharps PW. Self-rated mental health: Screening for depression and posttraumatic stress disorder among women exposed to perinatal intimate partner violence. J Psychosoc Nurs Ment Health Serv. 2015;53(11):32–8. https://doi.org/10.3928/02793695-20151021-02.
8. Miller-Graff LE, Cheng P. Consequences of violence across the lifespan: Mental health and sleep quality in pregnant women. Psychol Trauma Theory Res Pract Policy. 2017;9(5):587–95. https://doi.org/10.1037/tra0000252.
9. Baglioni C, Nanovska S, Regen W, Spiegelhalder K, Feige B, Nissen C, Riemann D. Sleep and mental disorders: A meta-analysis of polysomnographic research. Psychol bulletin. 2016;142(9):969.
10. Palagini L, Gemignani A, Banti S, Manconi M, Mauri M, Riemann D. Chronic sleep loss during pregnancy as a determinant of stress: Impact on pregnancy outcome. Sleep Med. 2014;15(8):853–9. https://doi.org/10.1016/j.sleep.2014.02.013.
11. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193–213. https://doi.org/10.1016/0165-1781(89)90047-4.
12. Martin JL, Hakim AD. Wrist actigraphy. Chest. 2011;139(6):1514–27. https://doi.org/10.1378/chest.10-1872.
13. Bei B, Coo S, Baker FC, Trinder J. Sleep in women: A review. Aust Psychol. 2015;50(1):14–24. https://doi.org/10.1111/ap.12095.
14. Mindell JA, Cook RA, Nikolovski J. Sleep patterns and sleep disturbances across pregnancy. Sleep Med. 2015;16(4):483–8. https://doi.org/10.1016/j.sleep.2014.12.006.
15. Izci-Balserak B, Keenan BT, Corbitt C, Staley B, Perlis M, Pien GW. Changes in sleep characteristics and breathing parameters during sleep in early and late pregnancy. J Clin Sleep Med : JCSM : Official Publication Am Acad Sleep Med. 2018;14(7):1161–8. https://doi.org/10.5664/jcsm.7216.
16. Walker N, Beek K, Chen H, Shang J, Stevenson S, Williams K, Herzog H, Ahmed J, Cullen P. The experiences of persistent pain among women with a history of intimate partner violence: A

systematic review. Trauma Violence Abuse. 2020;23(2):490–505. https://doi.org/10.1177/1524838020957989.
17. Kliewer W, Lepore SJ. Exposure to violence, social cognitive processing, and sleep problems in urban adolescents. J Youth Adolesc. 2015;44:507–17.
18. Craske MG, Tsao JC. Assessment and treatment of nocturnal panic attacks. Sleep Med Rev. 2005;9(3):173–84. https://doi.org/10.1016/j.smrv.2004.11.003.
19. Gallegos AM, Trabold N, Cerulli C, Pigeon WR. Sleep and interpersonal violence: A systematic review. Trauma Violence Abuse. 2021;22(2):359–69. https://doi.org/10.1177/1524838019852633.
20. Hathaway JE, Mucci LA, Silverman JG, Brooks DR, Mathews R, Pavlos CA. Health status and health care use of Massachusetts women reporting partner abuse. Am J Prev Med. 2000;19(4):302–7. https://doi.org/10.1016/s0749-3797(00)00236-1.
21. Newton TL, Burns VE, Miller JJ, Fernandez-Botran GR. Subjective sleep quality in women with divorce histories: The role of intimate partner victimization. J Interpers Violence. 2016;31(8):1430–52. https://doi.org/10.1177/0886260514567961.
22. Straus MA, Hamby SL, Boney-McCoy S, Sugarman DB. The revised conflict tactics scales (CTS2). J Fam Issues. 1996;17(3):283–316. https://doi.org/10.1177/019251396017003001.
23. Chapman H, Gillespie SM. The revised conflict tactics scales (CTS2): A review of the properties, reliability, and validity of the CTS2 as a measure of partner abuse in community and clinical samples. Aggress Violent Beh. 2019;44:27–35. https://doi.org/10.1016/j.avb.2018.10.006.
24. Radloff LS. The CES-D scale. Appl Psychol Meas. 1977;1(3):385–401. https://doi.org/10.1177/014662167700100306.
25. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder. Arch Intern Med. 2006;166(10):1092. https://doi.org/10.1001/archinte.166.10.1092.
26. Beard C, Björgvinsson T. Beyond generalized anxiety disorder: psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. J Anxiety Disord. 2014;28(6):547–52.
27. Blevins CA, Weathers FW, Davis MT, Witte TK, Domino JL. The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. J Trauma Stress. 2015;28(6):489–98. https://doi.org/10.1002/jts.22059.
28. Sveen J, Bondjers K, Willebrand M. Psychometric properties of the PTSD checklist for DSM-5: A pilot study. Eur J Psychotraumatol. 2016;7(1):30165. https://doi.org/10.3402/ejpt.v7.30165.
29. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh sleep quality index. J Psychosom Res. 1998;45(1):5–13. https://doi.org/10.1016/s0022-3999(97)00298-5.
30. Sadeh A, Hauri PJ, Kripke DF, Lavie P. The role of actigraphy in the evaluation of sleep disorders. Sleep. 1995;18(4):288–302. https://doi.org/10.1093/sleep/18.4.288.
31. Cole RJ, Kripke DF, Gruen W, Mullaney DJ, Gillin JC. Automatic sleep/wake identification from wrist activity. Sleep. 1992;15(5):461–9. https://doi.org/10.1093/sleep/15.5.461.
32. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Int J Nurs Stud. 2010;47(8):931–6. https://doi.org/10.1016/j.ijnurstu.2009.10.001.
33. Ludbrook J. Confidence in Altman–bland plots: A critical review of the method of differences. Clin Exp Pharmacol Physiol. 2010;37(2):143–9. https://doi.org/10.1111/j.1440-1681.2009.05288.x.
34. Bolin JH. Hayes, Andrew F. (2013). Introduction to Mediation, Moderation, and Conditional Process Analysis A Regression-Based Approach New York, NY: The Guilford Press. J Educational Meas. 2014;51(3):335–7.
35. Sedov ID, Cameron EE, Madigan S, Tomfohr-Madsen LM. Sleep quality during pregnancy: a meta-analysis. Sleep Med Rev. 2018;38:168–76.
36. Girschik J, Fritschi L, Heyworth J, Waters F. Validation of self-reported sleep against Actigraphy. J Epidemiol. 2012;22(5):462–8. https://doi.org/10.2188/jea.je20120012.
37. Lehrer HM, Yao Z, Krafty RT, Evans MA, Buysse DJ, Kravitz HM, Matthews KA, Gold EB, Harlow SD, Samuelsson LB, Hall MH. Comparing polysomnography, actigraphy, and sleep diary in the home environment: The study of women's health across the nation (SWAN) sleep study. SLEEP Adv. 2022;3(1):zpac001.
38. Walker R, Shannon L, Logan T. Sleep loss and partner violence victimization. J Interpers Violence. 2010;26(10):2004–24. https://doi.org/10.1177/0886260510372932.
39. Pinto RJ, Correia-Santos P, Costa-Leite J, Levendosky AA, Jongenelen I. Cortisol awakening response among women exposed to intimate partner violence. Psychoneuroendocrinology. 2016;74:57–64. https://doi.org/10.1016/j.psyneuen.2016.08.024.
40. Sim M, Kim S, Suh Y. Sample size requirements for simple and complex mediation models. Educ Psychol Measur. 2021;82(1):76–106. https://doi.org/10.1177/00131644211003261.
41. Enders C. K. (2022) Applied missing data analysis. Guilford Publications.
42. Gadson A, Akpovi E, Mehta PK. Exploring the social determinants of racial/ethnic disparities in prenatal care utilization and maternal outcome. In Seminars Perinatol. 2017;41(5):308–17.
43. March of Dimes. (2022). 2022 maternity care desert report. March of Dimes. Retrieved from https://www.marchofdimes.org/sites/default/files/2022-10/2022_Maternity_Care_Report.pdf

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