ORIGINAL ARTICLE

Clinical Sleep Disorder Profiles in a Large Sample of Trauma Survivors: An Interdisciplinary View of Posttraumatic Sleep Disturbance

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Study Objectives: To examine the relationship between psychiatric symptoms and self-reported sleep, sleepiness, and nightmare complaints in a convenience sample of 437 trauma survivors.
Method: Based on symptom severity reports, individuals were classified as having psychophysiological insomnia (PPI), chronic nightmare disorder (CND), and sleep-disordered breathing (SDB) profiles. Individuals with each symptom profile were compared to individuals without the respective profile on sleep indices, sleepiness-related impairment, and psychiatric distress (anxiety, depression, posttraumatic stress symptoms).
Results: Individuals with PPI (76%), CND (79%), SDB (68%), or all three profiles (46%) had significantly worse sleep onset latency, sleep efficiency, total sleep time, sleep-related functional impairment, and psychiatric distress compared to those without each disorder profile.
Conclusions: The majority of trauma survivors in this sample suffered from sleep complaints sufficiently severe to warrant independent clinical attention by sleep medicine specialists. Longitudinal studies are necessary to determine whether these disturbances are caused exclusively by PTSD or another sleep disorder comorbid with PTSD. **(Sleep and Hypnosis 2007;9(1):6-15)**

Key words: Insomnia, Nightmares, PTSD, Sleep-Disordered Breathing

INTRODUCTION

Posttraumatic sleep disturbance exemplifies the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV-TR) nosological paradigm, "Sleep Disorder Related to Another Mental Disorder." According to the DSM-IV-TR criteria (see Figure 1), this disorder "involves a prominent complaint of sleep disturbance that results from a diagnosable mental disorder but that is sufficiently severe to warrant independent clinical attention. Presumably, the pathophysiological mechanisms responsible for the mental disorder also affect sleep-wake regulation" (p. 597) (1).

Trauma survivors frequently experience prominent symptoms of insomnia and

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(A) The predominant complaint is difficulty initiating or maintaining sleep, or nonrestorative sleep, for at least 1 month that is associated with daytime fatigue or impaired daytime functioning.
(B) Sleep disturbance (or daytime sequelae) causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.
(C) The insomnia is related to another Axis I or Axis II disorder but is sufficiently severe to warrant independent clinical attention.
(D) The disturbance is not better accounted for by another sleep disorder.
(E) The disturbance is not due to the direct physiological effects of a substance or general medical condition.

Figure 1. Diagnostic and Statistical Manual-IV-TR Criteria for Sleep Disorder Related to Another Mental Disorder

nightmares that warrant independent clinical attention, but which are often presumed secondary to the global posttraumatic stress condition (2). In posttraumatic stress disorder (PTSD) literature, nightmares and insomnia are commonly and respectively described as intrusion and arousal symptoms and are not routinely investigated or treated as primary sleep disorders (3). Shorthand terms for these constructs are "psychiatric insomnia" (4) and "posttraumatic nightmares," (5) both of which imply a secondary relationship to another mental disorder.

Classification of PTSD sleep disturbances within the DSM-IV-TR psychiatric insomnia framework may be problematic as it convolutes when to refer patients for specific sleep medicine diagnosis and therapeutic expertise. Consider a trauma patient who, following PTSD treatment, still reports severe sleep maintenance insomnia likely explained by psychophysiological conditioning. This PTSD patient's sleep problem might now be more accurately termed Primary or Psychophysiological Insomnia (6). This "sleep disorder" ought to respond to sleep-oriented, cognitive-behavioral strategies (e.g., stimulus control or sleep restriction) (7), which target sleep problems but not posttraumatic stress symptoms. Technically, this patient no longer meets Criteria D (Fig. 1) because "another sleep disorder" (psychophysiological insomnia) has been diagnosed, which also requires "independent clinical attention." Yet, what catalyzed this psychophysiological conditioning if not the traumatic exposure or other posttraumatic stress symptoms, which in turn triggered anxiety about the bedroom environment along with subsequent alerting behavior at bedtime (8)? While this patient's insomnia would benefit from "independent clinical attention," arguments could be offered to either continue to view these sleep complaints within the PTSD paradigm or to revise the diagnosis to Primary Insomnia.

Recent studies suggest greater overlap in the pathophysiological mechanisms that underlie "insomnia due to a mental disorder" and "psychophysiological insomnia"(9,10). Instead of viewing these conditions distinctly, they may be more accurately understood along a continuum (9). In actual clinical care and research venues, however, the "sleep disorder related to another mental disorder" distinction seems to have biased both mental health and sleep medicine clinicians and researchers towards evaluating and treating sleep disturbances in trauma survivors as merely secondary complaints of PTSD (11).

To date, very few PTSD treatment studies have been designed to provide independent clinical attention to sleep disorders in trauma survivors (2,11). To our knowledge, no randomized controlled trials exist in the scientific literature in which trauma survivors received sleep treatments based on practice parameters from the field of sleep medicine; and, no studies used the gold standard tool of polysomnography before and after treatment. No controlled treatment studies report on the use of state-of-the-art respiratory assessment technology (i.e., esophageal manometry or nasal cannula pressure transducer) in a sample of trauma survivors to test for the full diagnostic spectrum of sleep-disordered breathing (12). Prevalence research on trauma survivors

rarely involves complete sleep medicine work-ups, comparable to standards used by board-certified sleep specialists in sleep disorders clinics (13). Trauma survivors are rarely evaluated with validated sleep scales (2) to assess insomnia, nightmares or sleep-disordered breathing as primary variables of interest.

Without using standard or evidence-based procedures from the field of sleep medicine to evaluate sleep disorders in trauma patients, it is difficult to gauge the impact of specific sleep disorders on PTSD symptoms or the impact of PTSD on these sleep disorders (11). Without a thorough sleep medicine work-up, clinicians are constrained in assessing the need for independent clinical attention in trauma patients. As recently documented, 93% of 168 sexual assault survivors with chronic posttraumatic sleep disturbance were rarely assessed by their primary physicians or therapist for "another sleep disorder" and were never referred to sleep specialists, despite averaging 13 years of serious and severe sleep complaints as well as myriad sleep disorders (14).

The objective of this study was to contrast and compare self-reported sleep indices, sleepiness-related impairment, and psychiatric distress between trauma survivors with or without three specific sleep disorder symptom profiles: psychophysiological insomnia, chronic nightmare disorder, and sleep disordered breathing. We hypothesized that each of these profiles would be strongly associated with (1) worse scores on standard self-report sleep indices and a sleepiness-related impairment scale; and (2) greater psychiatric distress. Support for these hypotheses would suggest that posttraumatic sleep disturbance is of sufficient severity in trauma survivors to warrant independent clinical attention by sleep medicine specialists. These findings would also provide preliminary data supporting the conceptualization of posttraumatic sleep complaints as "another sleep disorder(s)" rather than secondary symptoms of PTSD presumed to be independent of a sleep disorder(s).

METHODS

Participants

The sample comprised 384 women and 53 men seeking treatment for posttraumatic sleep disturbances, defined as complaints of nightmares or insomnia or both following traumatic exposure. Mean age was 40.62 years (SD= 12.88), and mean BMI was 26.90 (SD= 6.82). Data for this study were derived from baseline measures collected from participants in three separate treatment studies, which were conducted, completed, and published from 1995 to 2002 (12,14,15). All three studies were reviewed and approved by the institutional review board of the University of New Mexico Health Sciences Center, and all 437 participants provided verbal and written informed consent. Exclusion criteria were current substance abuse, psychosis, or an unstable mental health condition. Therapeutic procedures and results have been reported for each of the studies (12,14,15). The current work is a compilation of the baseline data from the three previous studies; however, the dataset was expanded with an additional sample of 120 crime victims not previously described in any publication. We also include quality of life data (n= 250) and anxiety and depression data (n= 198) in the current report, which have never been published.

Measures

At intake, all participants completed a battery of sleep and mental health questionnaires, which have been previously described (12,14,15). Information was then extracted (described below) allowing us to classify individuals into the following three

sleep disorder profiles that we have found to be most relevant to trauma patients: psychophysiological insomnia (PPI), chronic nightmare disorder (CND) and sleep-disordered breathing (SDB). We also extracted standard self-report sleep indices, including sleep onset latency (SOL), total sleep time (TST), and calculated sleep efficiency (SE%) from these questionnaires. For all patients, severity of posttraumatic stress symptom clusters (intrusion, avoidance, arousal) and total symptom severity was assessed by a validated PTSD scale (16). In two of the three studies, 250 patients also completed the Functional Outcomes of Sleep Questionnaire (FOSQ), (17) measuring sleepiness-related impairment, and 248 patients completed the Symptom Questionnaire (18), measuring anxiety and depression.

As a follow-up step in each of these three protocols, we recommended objective sleep testing for the 401 participants, who were suspected of a sleep-breathing disorder based on American Academy of Sleep Medicine research criteria symptoms (19). A total of 83 of these individuals underwent polysomnographic diagnostic testing at one of six local sleep center sites in New Mexico. Due to the variability of testing procedures at each site, no data are reported regarding EEG parameters or SDB indices. Instead, the diagnostic findings from the tests (SDB vs. no SDB diagnoses) were used to estimate the prevalence of SDB in the sub-sample tested.

Classification of Clinically Meaningful Sleep Disorder Profiles

A dichotomous categorization was used for each of the three sleep disorder profiles (PPI, CND, SDB). These categorizations were based on research criteria (19,20) or sleep medicine nosology (6). The criteria used to categorize these disorders were applied conservatively to insure that a sleep disorder of moderate severity or greater would be deemed a positive case, whereas less than moderate severity would be deemed a negative case.

Psychophysiological Insomnia (PPI). Insomnia severity was measured with three questions assessing difficulties falling asleep, staying asleep and early morning awakenings of a chronic nature, each scored on a 0 to 4 scale and summed to maximum score of 12. Because a score of 2 or greater on any single question corresponded to moderate insomnia, a total score > 6 was used to indicate clinically meaningful PPI symptoms.

Chronic Nightmare Disorder (CND). Nightmare frequency was measured on a continuous scale from 0 to 14 nightmares per week (2 per night). Individuals reporting nightmares > 1 per week of a chronic nature corresponded to a moderate degree of nightmare disturbance; this value determined the presence of a clinically meaningful CND symptoms.

Sleep Disordered Breathing (SDB). For sleep-disordered breathing symptoms, AASM research criteria (1999) were used to establish a presumptive classification based on the presence of Criteria A (sleepiness-type presentation), Criteria B (insomnia-type presentation) or both (Criteria AB) (19). Meeting either or both criteria indicate a presumptive diagnosis of SDB, depending ultimately upon objective documentation of the disorder. Among the 437 patients in the sample, 401 met subjective AASM criteria for SDB. As described above, 83 of these individuals (21% of suspected cases) underwent PSG testing; SDB diagnoses were confirmed in all patients tested. To determine whether those objectively tested were a representative subset of the entire sample of suspected SDB cases (n= 401), a series of one-way ANOVAs were conducted between the two groups (N= 83, tested and confirmed; N=318, untested but suspected) to compare demographic, sleep, and psychiatric variables. No statistically significant differences emerged between the

tested and untested groups, which was suggestive of a high prevalence of SDB cases in the entire sample.

Notwithstanding these objective findings, our clinical and research experience with trauma survivors has previously demonstrated marked clinical contrasts between those patients meeting Criteria AB compared to those in any other category (Criteria A, Criteria B, or No SDB) (21) In recent research, we have shown that Criteria AB patients suffer from moderate to severe SDB symptoms of greater intensity than other classifications. Therefore, the presence of a clinically meaningful form of SDB was based on the more conservative requirement of meeting Criteria AB (21).

Data Analyses

After participants were classified dichotomously into the three, clinically meaningful sleep disorder symptom categories described above, we conducted preliminary descriptive analyses. Next and prior to testing the two primary hypotheses, the impact of relevant moderator variables that might qualify the relationship between the thre e sleep disorder profiles and the dependent variables were tested by separate ANOVAs including both main effects and an interaction term (moderator x disorder). Three potential moderating variables (age, sex, and BMI) were tested. Significant interactions and the associated main effect were included in the analyses as appropriate. For Hypothesis 1, which predicted that clinically meaningful sleep disorder profiles would be associated with worse sleep indices and sleepiness-related impairment, ANOVA was employed to test for differences on sleep parameters between the presence vs. absence of each disorder (PPI, CND, SDB). Each ANOVA separately tested whether individuals with each disorder differed significantly from individuals without the disorder on SOL, TST, and calculated SE%. The groups were also tested for differences in sleepiness-related impairment on the FOSQ global scores in a smaller subset of patients (N=250).

For Hypothesis 2, which predicted that clinically meaningful sleep disorder profiles would be associated with greater psychiatric distress, ANOVA was employed to test for differences between individuals with and without each profile (PPI, CND, SDB) on total posttraumatic stress severity for all participants (N=437). For each statistically significant difference, symptom clusters of intrusion, avoidance, and arousal severity replaced the total posttraumatic stress severity score in order to further characterize group differences. A similar procedure was employed for testing differences in the anxiety and depression symptom scores for individuals with vs. without each disorder in a subset of patients (n= 248).

For each analysis, effect sizes were computed using Cohen's d, the standardized difference between means of those with and without each disorder on each dependent variable, defined as small, medium, and large effect sizes or d= 0.20, 0.50, 0.80, respectively.

RESULTS

Descriptive Analyses

Individuals had a mean score of 27.82 (SD= 12.52) on the Posttraumatic Stress Diagnostic Scale, which is in the range of moderate to severe PTSD symptomatology. The majority of patients (69%) had PDS scores in at least the moderate range. Participants in the subsample who completed the SQ had clinically moderate to severe levels of depression (M= 12.10, SD= 6.58) and anxiety (M= 14.36, SD= 5.80).

Based upon criteria described above for clinically meaningful disorders, 76% of individuals (n= 334) had moderate to severe symptoms of PPI, 79% of individuals (n= 344) had symptoms of CND (nightmares

occurring weekly or more frequently), 68% of individuals (n= 298) had symptoms of SDB (AASM Criteria AB), and 46% of individuals (n= 202) had all 3 symptom profiles.

Moderating Variables

The potential moderating relationships between age, sex, and BMI and sleep disorder were analyzed by ANOVA, testing for main effects and interaction terms (moderator x symptom profile) as independent variables on each dependent variable (SOL, TST, SE%, FOSQ, PDS total, SQ Depression, and SQ Anxiety) in separate analyses. Of the 63 analyses, only 3 interaction terms were statistically significant. BMI x SDB interactions emerged for SOL ($F_{1,431}$= 8.36, p< .01), and BMI x PPI interactions were also seen for TST ($F_{3,431}$= 4.48, p< .05) and FOSQ values ($F_{1,244}$= 4.48, p< .05). All interactions showed small effect sizes. No moderator x group interactions were statistically significant when predicting psychiatric distress measures. These moderating effects were not included in the main analyses because effect sizes were small, and 3.15 significant interactions would be expected by chance alone.

Hypothesis 1: Clinically Meaningful Sleep Disorder Profiles, Sleep Indices, and Sleep-Related Impairment (Table 1)

Psychophysiological Insomnia. Individuals with PPI symptoms, compared to those without PPI symptoms, showed significantly worse scores on subjective sleep measures, including increased sleep onset latency (d= 0.69), decreased total sleep time (d= 1.00), decreased sleep efficiency (d= 0.87), and lower FOSQ scores (d= 0.58).

Chronic Nightmare Disorder. Individuals with CND symptoms, compared to those without CND symptoms, also showed significantly worse scores on subjective sleep measures, including increased sleep onset latency (d= 0.25), decreased sleep efficiency (d= 0.33), lower FOSQ scores (d= 0.61), and only marginally reduced total sleep time (d= 0.22).

Sleep Disordered Breathing. Individuals

Table 1. Comparisons between individuals with and without psychophysiological insomnia (PPI), chronic nightmare disorder (CND), and sleep disordered breathing (SDB) on subjective sleep measures

Sleep Measures	M	(SD)	M	(SD)	F[a]	p <	d
	PPI (n= 334)		No PPI (n= 103)				
SOL	59.54	(46.46)	30.80	(36.97)	32.96	.001	.69
TST	5.17	(1.63)	6.75	(1.54)	75.39	.001	1.00
SE%	67.45	(18.62)	82.21	(15.16)	53.73	.001	.87
FOSQ	14.04	(3.42)	15.84	(2.80)	14.96	.001	.58
	CND (n= 344)		No CND (n= 93)				
SOL	55.01	(47.65)	44.45	(38.50)	3.88	.05	.25
TST	5.47	(1.81)	5.82	(1.46)	2.98	.10	.22
SE%	69.67	(19.31)	75.60	(16.65)	7.31	.01	.33
FOSQ	13.92	(3.44)	15.88	(3.00)	19.40	.001	.61
	SDB (n= 298)		No SDB (n= 139)				
SOL	55.68	(49.16)	46.50	(37.84)	3.80	.10	.21
TST	5.36	(1.84)	5.94	(1.44)	11.17	.001	.36
SE%	68.72	(19.57)	75.65	(16.55)	13.07	.001	.38
FOSQ	13.63	(3.38)	16.52	(2.60)	45.79	.001	.97
	3 disorders (n= 202)		< 3 disorders (n= 235)				
SOL	62.18	(49.05)	44.67	(41.67)	16.27	.001	.39
TST	5.04	(1.77)	5.98	(1.61)	33.97	.001	.56
SE%	65.95	(19.83)	75.21	(17.01)	27.60	.001	.50
FOSQ	12.71	(3.38)	15.66	(2.95)	52.33	.001	.93

Note. SOL= sleep onset latency. TST= total sleep time. SE%= sleep efficiency. N= 437. FOSQ= Functional Outcomes of Sleep Questionnaire. FOSQ N= 250.
d= Cohen's d, the standardized mean difference.
[a]df= 1, 435 except for FOSQ df= 1, 248.

Table 2. Comparisons on psychiatric distress measures between individuals with vs. without psychophysiological insomnia (PPI), chronic nightmare disorder (CND), and sleep disordered breathing (SDB).

Psychiatric Distress Measures	M	(SD)	M	(SD)	F[a]	p <	d
	PPI (n = 334)		No PPI (n = 103)				
PDS Global	30.14	(11.92)	20.32	(11.49)	54.30	.001	.84
PDS Intrusion	8.50	(4.20)	5.37	(3.44)	47.22	.001	.82
PDS Avoidance	11.36	(5.80)	8.10	(5.63)	25.29	.001	.57
PDS Arousal	10.27	(3.67)	6.87	(3.94)	65.11	.001	.89
Depression SQ	12.99	(6.57)	9.93	(6.13)	11.55	.001	.48
Anxiety SQ	15.34	(5.58)	11.99	(5.68)	18.20	.001	.59
	CND (n = 344)		No CND (n = 93)				
PDS Global	30.52	(11.83)	17.85	(9.66)	90.30	.001	1.18
PDS Intrusion	8.64	(4.10)	4.51	(3.05)	82.29	.001	1.16
PDS Avoidance	11.65	(5.72)	6.67	(4.91)	58.88	.001	.94
PDS Arousal	10.23	(3.71)	6.68	(3.82)	66.17	.001	.94
Depression SQ	13.47	(6.73)	9.34	(5.30)	23.58	.001	.69
Anxiety SQ	16.05	(5.29)	10.94	(5.29)	51.33	.001	.97
	SDB (n = 298)		No SDB (n = 139)				
PDS Global	30.52	(11.75)	22.04	(12.20)	48.26	.001	.71
PDS Intrusion	8.40	(4.25)	6.40	(3.92)	22.04	.001	.49
PDS Avoidance	11.73	(5.63)	8.16	(5.81)	37.36	.001	.62
PDS Arousal	10.39	(3.62)	7.50	(4.08)	55.88	.001	.75
Depression SQ	12.95	(6.57)	10.33	(6.28)	8.92	.01	.41
Anxiety SQ	15.06	(5.51)	12.90	(6.16)	7.71	.01	.37
	3 disorders (n = 202)		< 3 disorders (n = 235)				
PDS Global	34.47	(9.82)	22.11	(11.77)	139.41	.001	1.15
PDS Intrusion	9.81	(3.81)	6.00	(3.79)	109.51	.001	1.00
PDS Avoidance	13.14	(5.04)	8.40	(5.74)	82.88	.001	.88
PDS Arousal	11.51	(2.80)	7.71	(4.05)	125.97	.001	1.11
Depression SQ	14.66	(6.83)	10.62	(5.97)	23.65	.001	.63
Anxiety SQ	16.99	(4.82)	12.84	(5.79)	33.28	.001	.78

Note. PDS= Posttraumatic Distress Scale. PDS N= 437. SQ= Symptom Questionnaire. SQ N= 248.
d= Cohen's d, the standardized mean difference.
[a]PDS df= 1, 435; SQ df= 1, 246

with SDB symptoms, compared to those without SDB, showed worse scores on subjective sleep measures, including decreased total sleep time (d= 0.36), decreased sleep efficiency (d= 0.38), lower FOSQ scores (d= 0.97), and only marginally reduced sleep onset latency (d= 0.21).

Hypothesis 2: Clinically Meaningful Sleep Disorder Profiles and Psychiatric Distress (Table 2)

Psychophysiological Insomnia. Patients with PPI symptoms, compared to those without PPI symptoms, systematically exhibited more psychiatric distress, including worse global posttraumatic stress severity (d= .84) as well as worse intrusion (d= .82), arousal (d = .89), and avoidance (d=.57) symptom clusters. They also had more severe self-rated depression (d= .48) and anxiety (d= .59).

Chronic Nightmare Disorder. Similar systematically large effect sizes were seen for individuals with CND symptoms on psychiatric distress scales. Individuals with CND symptoms had worse global (d= 1.18), intrusion (d= 1.16), arousal (d= .94), and avoidance (d= .94) posttraumatic stress severity than individuals without CND symptoms. They also had worse self-rated depression (d= .69) and anxiety (d= .97).

Sleep Disordered Breathing. SDB symptom patients exhibited worse psychiatric distress, including worse global (d= .71), intrusion (d= .49), arousal (d= .75), and avoidance (d= .62) posttraumatic stress symptom severity compared to individuals without SDB. They also had worse self-rated depression (d= .41) and anxiety (d= .37).

Among patients who reported having symptoms of all 3 disorders (PPI, CND, SDB) (n= 202), sleep indices, sleepiness-related impairment scores, and psychiatric distress measures were generally of greater severity than individuals who had symptoms for less than 3 disorders (see Tables 1 and 2).

DISCUSSION

We examined symptomatic profiles of three common sleep disorders and their associations with standard sleep indices, sleepiness-related impairment, and psychiatric distress in a cross-sectional study of trauma survivors seeking treatment for sleep problems. In every instance, individuals with versus those without insomnia, nightmares, and/or sleep-disordered breathing symptoms exhibited substantially worse psychiatric distress. Impairment by daytime sleepiness (FOSQ scores) was also consistently worse in individuals with PPI, CND, and SDB compared to individuals without each disorder. Most standard sleep indices were systematically worse for patients with these sleep disorders, albeit with variable effect sizes.

As each of these three disorders can be successfully treated with established, evidence-based sleep medicine treatments (7,20,22,23), it is reasonable to infer that each of these conditions, in a trauma survivor, would benefit from independent clinical attention by a sleep medicine specialist. Moreover, treating trauma survivors with evidence-based sleep medical therapies would likely inform psychiatric nosology. Previous data suggest that insomnia is often a residual symptom of PTSD (24) and that evidence-based sleep medicine treatments in trauma survivors leads to improvements in anxiety, depression, and posttraumatic stress symptoms (20,25-29). Improvement in sleep indices and sleepiness-related impairment would be expected outcomes in trauma survivors receiving independent clinical attention by sleep specialists (30), unless psychiatric factors were the sole cause of their symptoms and impairment (4).

These findings also support the use of a sleep medicine nosology to more accurately define sleep disorders associated with posttraumatic stress (6). Categorizing each of these profiles as "another sleep disorder," or perhaps as co-morbid with PTSD, might encourage clinicians to refer these types of patients to sleep centers for appropriate sleep medicine care (14).

Regardless of primary etiology of these sleep symptoms, the current findings emphasize potential strengths and limitations in the conceptualization of "sleep disorder related to another mental disorder" with respect to posttraumatic sleep disturbance. Whereas traumatic exposure has a harmful and complex patho-physiological impact on sleep (31), clinical sleep disorders left in the wake of trauma may persist for years and take on a life of their own (2,11).

When sleep disturbances become entrenched, it necessitates treatments from a specialty field to which mental health practitioners may not routinely refer patients. Behavioral sleep medicine specialists may also have an important role in the prevention and early treatment of sleep disorders in trauma survivors. Likewise, trauma patients may be cared for by sleep specialists with little or no training in treating PTSD. Therefore, collaboration between mental health and sleep clinicians and researchers is essential for future studies and clinical care. Such investigations align with the interdisciplinary model outlined in the NIH Roadmap (32).

These findings are not without limitations. First, these participants were trauma survivors seeking treatment for nightmares and insomnia. Because their sleep complaints were bothersome enough to induce them to seek sleep treatments, they are likely to be

unrepresentative of other trauma populations. Trauma survivors seeking care at mental health facilities might have fewer sleep disturbances and more psychiatric symptoms. Also, these trauma survivors had high comorbid complaints of depression; this comorbidity is consistent with other studies assessing affect dysregulation in PTSD (33) Given the established association between depression and sleep disturbance (34), it may be that depression mediates the relationship between trauma exposure and sleep. We were unable to control for other variables that may cause sleep disruption, such as medical issues, poor sleep hygiene, and medication use; thus, these factors may also qualify the relationship between sleep and PTSD symptoms.

Another methodological concern is the inability to verify sleep disorders by objective testing in more participants. Polysomnography would increase the validity of the sleep disorder classifications, especially the SDB findings. Despite the added costs, future studies would be enhanced by expanded protocols that use objective polysomnographic testing with advanced respiratory monitoring (19) for treatment-seeking PTSD patients complaining of posttraumatic sleep disturbances.

In conclusion, this study documented worse sleep symptoms and distress in relationship to insomnia, nightmares, and sleep-disordered breathing symptoms in a large sample of treatment-seeking trauma survivors. We believe it is reasonable to conclude that these conditions need "independent clinical attention" in PTSD patients with more severe psychiatric distress. Future investigations must clarify whether or not there is clinical utility in defining each of these conditions as "another sleep disorder," or more precisely, as a "co-morbid" condition. All things considered, the current study illustrates that the field of sleep medicine may have useful resources to offer certain patients suffering from posttraumatic sleep disturbance.

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