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Sleep-Disordered Breathing, Psychiatric Distress, and Quality of Life Impairment in Sexual Assault Survivors

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Using American Academy of Sleep Medicine research criteria, sleep-disordered breathing (SDB) was assessed in a pilot study of 187 sexual assault survivors with posttraumatic stress symptoms. Nightmares, sleep quality, distress, and quality of life were also assessed along with historical accounts of prior treatments for sleep complaints. Presumptive SDB diagnoses were established for 168 patients. Twenty-one of 168 underwent sleep testing, and all met objective SDB diagnostic criteria. There were no clinically meaningful differences in age, body-mass index, sleep quality, distress, or quality of life measures between 21 confirmed SDB cases and 147 suspected cases not tested. Compared with 19 women without SDB, 168 women with diagnosed or suspected SDB reported significantly worse nightmares, sleep quality, anxiety, depression, posttraumatic stress, and impaired quality of life. Despite suffering from sleep problems for an average of 20 years, which had not responded to repeated use of psychotropic medications or psychotherapy, few of these women had been referred to sleep specialists. SDB appears widespread among sexual assault survivors seeking help for nightmares. Research is needed to clarify the associations among SDB, distress, and physical and mental health impairment in trauma patients.

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Schnurr and Friedman (1995) have asserted that "PTSD promotes poor health through a complex interaction between biological and psychological mechanisms" and that "crucial medical/mental health collaborative initiatives are needed to address the problem of trauma-related medical illness." Furthermore, they have shown that medical services utilization is increased among patients with posttraumatic stress disorder (PTSD) (Schnurr et al., 2000). Clum et al. (2001) have shown that posttraumatic sleep disturbance predicted unique variance of physical health symptoms in treatment-seeking female rape victims. However, the psychophysiological paradigm reflected in these three studies on posttraumatic stress has not been integrated into the prevailing model currently in use to explicate sleep disturbance in PTSD (American Psychiatric Association, 1994). In this model, insomnia and nightmares—two very common sleep complaints in PTSD—are almost invariably alleged to be the result of hyperarousal and intrusive processes that would be expected to respond to standard posttraumatic stress therapies (Ballenger et al., 2001). Although this perspective is widely accepted, it has never been validated using evidence-based, standardized sleep medicine principles.

In contrast, we have documented an extraordinary prevalence of comorbid behavioral and medical sleep disorders in trauma patients (Krakow et al., 2000a, 2000b, 2001a) and have hypothesized that these comorbid disorders play an influential role in promoting sleep disturbance in PTSD (Krakow et al., 2001c, 2000d). For example, sleep-oriented cognitive-behavioral therapies significantly decreased nightmares and insomnia among patients with PTSD (Krakow et al., 2001b, 2000c, 2001c) without concomitant use of standard psychiatric interventions.

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One controlled study treated nightmares in sexual assault survivors (Krakow et al., 2001b, 2000c), and the other study combined evidence-based treatments for insomnia and nightmares in a sample of crime victims (Krakow et al., 2001c). Posttraumatic stress symptoms decreased in association with improvements in sleep, and more than 50% of patients decreased their posttraumatic stress by one level of clinical severity, on average from the moderately severe to the moderate range.

Despite the impressive results of these brief, sleep-oriented approaches, residual sleep symptoms in the form of insomnia and poor sleep quality persisted in many patients. A similar finding was noted in a recent PTSD treatment study using sertraline in which residual poor sleep quality was documented, and 35% of the treated sample reported insomnia as an adverse effect (Davidson et al., 2001). Unresolved posttraumatic stress symptoms or medication side effect would be the most plausible explanations for persistent sleep complaints in patients with PTSD according to the prevailing paradigm (Kilpatrick et al., 1998). However, we have observed that the medical disorder known as sleep-disordered breathing (SDB) may be associated with both presenting and residual sleep complaints, including insomnia, in trauma patients (Krakow et al., 2000d, 2001e).

SDB involves upper airway obstruction (complete or partial) in the form of obstructive sleep apnea (OSA; Guilleminault, 1994) or more subtle sleep breathing disruption in the form of upper airway resistance syndrome (UARS; Guilleminault et al., 1995), either of which often produces hundreds of nocturnal electroencephalographic (EEG) arousals and brief awakenings during a single night of sleep. Both OSA and UARS cause or exacerbate insomnia in certain patients (Frederickson and Krueger, 1994; Krakow et al., 2001d; Lofaso et al., 1997; Morin, 1993). In studies of treatment-seeking trauma patients, diagnostic SDB symptoms were reported by half of the sample and were associated with worse sleep quality, posttraumatic stress, depression, and suicidality (Krakow et al., 2000a, 2000b, 2001a). In three case series, PTSD patients treated for SDB with continuous positive airway pressure (CPAP)—the gold standard therapy (Guilleminault, 1994)—reported improvements in insomnia (Krakow et al., 2000d; Melendrez et al., 2001; Youakim et al., 1998), nightmares, and posttraumatic stress symptoms (Krakow et al., 2000d; Youakim et al., 1998).

To effectively assess trauma patients with suspected comorbid SDB, sleep medicine evaluations need to be conducted in accordance with American Academy of Sleep Medicine (AASM) practice parameters, which generally encompass four major clinical areas (Aldrich, 2000). First, a psychiatric patient suspected of having a sleep disorder must undergo a thorough sleep medical and sleep mental health history (Kupfer and Reynolds 3rd, 1997). Second, a focused review of systems could uncover signs and symptoms of SDB, including nocturia, awakening with a dry mouth, morning headache, or difficulty with memory or concentration (American Academy of Sleep Medicine, 1999; American Sleep Disorders Association, 1990; Guilleminault, 1994). Third, physical examination may determine hypertension or obesity, which are known signs associated with SDB (American Academy of Sleep Medicine, 1999; American Sleep Disorders Association, 1990), and a cursory glance at craniofacial anatomy may show a small jaw, crowded airway, or narrow face, all of which have been linked to airway resistance (Guilleminault et al., 1995). The final clinical step is the sleep laboratory assessment using polysomnography (PSG), and a careful review of the first three clinical areas will almost always clarify the need for PSG (American Academy of Sleep Medicine, 1999; Chesson et al., 2000).

Epidemiological research examining SDB prevalence in trauma patients is urgently needed to evaluate this comorbidity model of sleep disturbance in PTSD (Krakow et al., 2001a, 2001e). As a preliminary step, the current pilot study examined a sample of sexual assault survivors with nightmares, insomnia, and posttraumatic stress symptoms to achieve four objectives: a) assess the sample by using the most recent AASM research criteria for SDB (Figure 1), b) test for SDB in a representative subsample of participants, c) correlate SDB with distress and physical and mental health impairment, and d) describe patients' prior experiences in seeking treatment for chronic sleep complaints.

Methods

Background

The study was approved by the University of New Mexico Health Sciences Center Human Research and Review Committee and was conducted as a follow-up to an earlier work in which female sexual assault survivors had participated in a nightmare treatment protocol from 1995 to 1999 (Krakow et al., 2001b, 2000c). All patients who enrolled in this new study provided oral and written consent in addition to consent provided at intake for the nightmare treatment protocol. Many of these patients had been evaluated for SDB (Krakow et al., 2000a, 2000b, 2001a) based on self-reported loud snoring and

SDB = Criterion A (Sleepiness Type) or Criterion B (Insomnia Type) plus Criterion C (Objective Evidence)

Criterion A: Excessive Daytime Sleepiness (N = 138)[a]

Qualifying Questions

Feelings of excessive daytime sleepiness.[b]

or

Fall asleep or doze momentarily-watching TV, reading,etc.[b]

or

Fall asleep or doze momentarily-at meetings, at church,etc.[b]

or

Need for coffee or other stimulant to stay awake during the day.[b]

OR

Criterion B: (Two or more of the following)

- **Choking or gasping during sleep (N = 50)**[a]
  Qualifying Questions
  According to what others have told you, how often-if ever-do you gasp, choke, or make snorting sounds during sleep?[b]
  or
  How often, if ever, have you awakened suddenly with the feeling of gasping or choking?[b]
- **Recurrent awakenings from sleep (N = 126)**[a]
  Qualifying Question
  How often, if ever, do you wake up repeatedly during the night?[b]
- **Unrefreshing sleep (N = 148)**[a]
  Qualifying Questions
  How often, if ever, do you not feel rested during the day, no matter how many hours of sleep you had?[b]
  or
  How would you rate your sleep quality overall?[c]
- **Daytime Fatigue (N = 73)**[a]
  Qualifying Question
  How much of a problem has it been for you to keep up enough enthusiasm to get things done?[d]
- **Impaired concentration (N = 98)**[a]
  Qualifying Question
  Have you found it difficult to concentrate on what you were doing or on things going on around you?[e]

PLUS

Criteria C: Overnight monitoring demonstrates 5 or more obstructed breathing events per hour during sleep. These events may include any combination of obstructive apneas/hypopneas or respiratory effort related arousals (RERA).

Condition
Obstructive Sleep Apnea (OSA)

Method of Measurement	Diagnostic Criteria
Nasal Cannula Pressure Transducer for polysomnography and Autoset.	Subject must demonstrate 5 or more obstructive apnea or hypopnea events per hour during sleep.
Thermal Sensor	Subject must demonstrate 5 or more obstructive apnea or hypopnea events per hour during sleep.

Condition
Upper Airway Resistance Syndrome (UARS)

Method of Measurement	Diagnostic Criteria
Nasal Cannula Pressure Transducer	Subject must demonstrate less than 5 obstructive apnea or hypopnea events per hour but have a total apnea, hypopnea, RERA index of 15 events/hr.
Thermal Sensor	Subject must demonstrate less than 5 obstructive apnea or hypopnea events per hour but have subtle airflow irregularities coupled with EEG micro-arousal activity or the presence of intermittent or frequent cresecendo snoring culminating in an EEG micro-arousal.
Autoset Flattening	Subject must demonstrate less than 5 obstructive apnea or hypopnea events per hour but have a Flattening Index (FI) of below .15 for 20% of the night. A FI > 20% indicates that the patient has spent 20% of the study time below 0.15 cutoff, which has proven to be consistent with SDB even when the AHI < 5.

FIGURE 1. American Academy of Sleep Medicine research criteria for sleep-disordered breathing. [a]N = number of patients with sleep-disordered breathing who endorsed this qualifying symptom. [b]Subjects had to answer "often" or "almost always" to qualify. Question from the Sleep Survey from the University of Wisconsin, Wisconsin Sleep Cohort Study. [c]Subjects had to answer "very bad" to qualify. Question from the Pittsburgh Sleep Quality Index. [d]Subjects had to answer "a very big problem" to qualify. Question from the Pittsburgh Quality Index. [e]Subjects had to have a frequency of "much of the time" or an intensity of "severe." Question from the Clinician-Administered PTSD Scale.

sleepiness, pathognomonic symptoms of SDB (American Sleep Disorders Association, 1990); preliminary SDB diagnoses were suspected in the majority of women. However, these patients have never been evaluated with more recent AASM research criteria for SDB (American Academy of Sleep Medicine, 1999), and none had been tested with objective sleep studies to confirm SDB diagnoses.

AASM Criteria for SDB

New AASM guidelines were established to "facilitate comparability of studies for research purposes" in the assessment of SDB. In addition, and of particular interest to fields outside of sleep medicine, these new guidelines addressed the inadequacy of emphasizing symptomatic presentations based on loud snoring and sleepiness, which in fact did not match complaints of many patients suffering from clinically impairing SDB (American Academy of Sleep Medicine, 1999; Krakow et al., 2001d). New diagnostic criteria were recommended, which in addition to sleepiness (criterion A) provided a means for assessing atypical presentations; criterion B lists five symptoms (Figure 1), of which the patient need only report two to meet minimum criteria for a preliminary SDB diagnosis "unless these symptoms are otherwise explained." Four of these symptoms (unrefreshing sleep, daytime fatigue, recurrent awakenings, and impaired concentration) describe an insomnia-type pattern, which accurately reflects how some SDB patients present (Krakow et al., 2001d). This symptom cluster also conforms to the kind of sleep complaints reported by psychiatric patients (Buysse et al., 1994; Kupfer and Reynolds 3rd, 1997; Nowell et al., 1997), and therefore provides a means for assessing atypical SDB presentations that might be more common among psychiatric patients (Reite, 1998; Ford and Kamerow, 1989). The criteria, however, are defined categorically and may be too sensitive. Thus, for this study, we developed a more stringent assessment by adding a frequency or an intensity component to criteria A and B. A positive rating required that the complaint occurred with regularity or was very problematic. Frequency and intensity questions were extracted from instruments described below and are itemized in Figure 1. To confirm an SDB diagnosis, criterion C requires objective evidence of SDB; this criterion was revised in response to advances in respiratory monitoring technology demonstrating that subtle breathing disruptions, known as respiratory-effort–related arousals, must be assessed along with standard apneas and hypopneas (American Academy of Sleep Medicine, 1999). This criterion change is especially relevant to PTSD research because all previous studies on sleep and PTSD (Pillar et al., 2000) except for one very recent report (Krakow et al., 2001e) have not assessed for subtle sleep breathing disruption.

Objective Sleep Tests

Intake interview records for 187 women were examined using AASM criteria (Figure 1). Contact was then attempted for all patients who received a preliminary SDB diagnosis; however, these attempts occurred from 1 to 5 years after patients completed or withdrew their participation in the nightmare treatment protocol. This resulted in small, but as described below, representative participation. Based on availability of equipment and patient choice, objective sleep tests included three options: a) PSG coupled with nasal pressure transducer—an advanced respiratory assessment technology (Hosselet et al., 1998), b) PSG coupled with a standard thermal sensor, and c) an Autoset portable monitoring device with a built-in nasal pressure transducer (Gugger, 1997). Standard procedures for PSG hook-up and scoring were used; additional details on nasal pressure transducers and Autoset have been provided in a recent report on a different sample of crime victims (Krakow et al., 2001e; summarized in Figure 1). All tested patients had met criterion A and/or B and were assessed for criterion C based on PSG or Autoset findings. Tests were scored by a registered PSG technician (M. P.) who was blinded from the study and were interpreted by a board-certified sleep specialist (B. K.) who was not blinded. In those with PSG/thermal sensor, the standard apnea-hypopnea index (AHI) greater than 5 was used (American Academy of Sleep Medicine, 1999). In those undergoing PSG/nasal pressure transducer, SDB diagnosis was based on a conservative index of apneas plus hypopneas plus respiratory-effort–related arousals (AHRI) greater than 15 events per hour (Hosselet et al., 2001). Autoset automatically calculates AHI and a flattening index (FI), the latter being an indirect assessment of respiratory-effort-related arousals or upper airway resistance. Autoset SDB diagnostic cut-offs, based on either AHI > 5, or AHI < 5 events and FI $> 20\%$, have previously been reported in a series of crime victims (Krakow et al., 2001e). If objective criteria were met, then patients were assigned a diagnosis of OSA or UARS. Patients were not prompted to continue or discontinue psychotropic medication before objective sleep tests.

Sleep and Distress Assessments

Data were extracted from all 187 intake records, including all contacted as well as all unreachable patients. Thus, data were available for those with or without a presumptive SDB diagnosis. Seven validated scales assessed sleep quality, anxiety, depression, PTSD, nightmares, and quality of life: Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989), Clinician Administered PTSD Scale (CAPS; Blake et al., 1990), PTSD Symptom Scale (Foa et al., 1993), Nightmare Frequency Questionnaire (Krakow

et al., in press), Hamilton Depression Rating Scale (HAM-D; Hamilton, 1967), Hamilton Anxiety Scale (Hamilton, 1969), and Rand SF-36 (Ware et al., 1994). Insomnia profiles (sleep onset latency, total sleep time, and sleep efficiency [total sleep time/time in bed]) were obtained from the PSQI, and relevant items were extracted from Wisconsin Cohort Sleep Survey (Young et al., 1993), PSQI, and CAPS as described in Figure 1 to determine qualifying symptoms for AASM criterion A or B. Intake information was reviewed for the following parameters: age of initial trauma, exposure to multiple traumatic events, age of onset of sleep disturbance, medications prescribed for insomnia and psychiatric distress, types of mental health practitioners encountered, prior sleep medicine assessments and treatments offered, referrals to sleep disorders centers, and clinical sleep tests completed.

Data Analysis

Multivariate analysis of variance was the primary analytic technique to assess four sets of correlated outcomes for those participants who completed the necessary instruments: a) insomnia profile items (N = 187); b) sleep quality, nightmares, and PTSD scales (N = 187); c) anxiety and depression scales (N = 160); and d) quality of life scales (N = 185). Contingency coefficients and chi-square analyses were used for categorical variables. Main outcome measures were analyzed according to three independent variables: a) participation in current protocol (participated, refused, or unreachable); b) SDB status by AASM criteria (SDB or no SDB); and c) objective testing of suspected SDB cases (tested or not tested). An exploratory analysis examined types of presenting complaints in SDB cases, based on AASM criteria (criterion A, sleepiness; criterion B, insomnia-type; and criteria A and B). Statistical significance was set at .05. Cohen's d, the standardized mean difference, was calculated to assess effect sizes between groups.

Results

Patient Sample and Characteristics

For all 187 women, mean (SD) age was 37 (SD = 11) years with a mean body mass index (BMI) of 27.0 (SD = 7.6). Median BMI was normal at 25.0, indicating that the sample averaged approximately 10 to 12 lb above normal, although half of the sample was normal or below normal weight. The sample consisted primarily of non-Hispanic whites (62%) and Hispanics (18%). Most participants were not married, averaged household income at or less than $20,000, and reported some college or higher education. These women suffered from moderate to severe self-reported insomnia, nightmares, poor sleep quality, anxiety, depression, posttraumatic stress symptoms, and impaired quality of life.

AASM SDB Criteria

Of 187 women, 168 met SDB diagnostic criteria A and/or B, and patient responses to qualifying questions showed a marked propensity for the combination of sleepiness and insomnia presentations (N = 125) versus sleepiness only (N = 13) and insomnia only (N = 30). Of these 168 potential SDB cases, 43 were contacted and 125 were unreachable because of disconnected phone numbers and changes of addresses. Of the 43 contacted, 21 enrolled and completed sleep tests, and 22 refused tests. For these three groups (21 participated, 22 refused, 125 unreachable), which comprised all 168 potential SDB cases, there was 1 statistically significant difference (mental health subscale of SF-36) on six demographic and 18 outcome variables (Table 1); and the same, single item difference was found comparing 21 tested and 147 untested (22 refusers plus 125 unreachable). In addition, when controlling for anxiety and depression, the overall pattern of general equivalence between the two groups was essentially unchanged. Therefore, because these two groups appear both statistically and clinically very similar, subsequent analyses assumed that 21 objectively tested and 147 untested comprised a single group (N = 168) of diagnosed or suspected SDB patients.

Objective Testing

All 21 patients tested met objective SDB criteria. Of 9 tested with PSG and nasal pressure transducer, the mean AHI was 13 (SD = 10.5) events per hour, whereas the mean AHRI was 39 (SD = 22.0) events per hour (OSA = 5; UARS = 4). Of seven tested with PSG and thermal sensor, the AHI was greater than 10 events per hour in three cases of OSA and less than 5 events per hour in 4 cases of UARS. Of 5 tested with Autoset, mean FI was 38% (SD = 11%), well above the cutoff of 20% for UARS (OSA = 2; UARS = 3). Overall, 11 cases of UARS and 10 cases of OSA were diagnosed. Only 13 of 21 patients objectively demonstrated snoring, and 16 patients maintained their current use of psychotropic medications before or during the sleep test.

Sleep and Distress Relationships

Comparisons between 168 diagnosed or suspected SDB cases and 19 no SDB cases (Table 2)

TABLE 1
Characteristics and Participation Status of 168 Sexual Assault Survivors with Potential Sleep-Disordered Breathing

Characteristics	Objective Testing (N = 21)	Refused Testing (N = 22)	Unreachable (N = 125)	p-Value[a]
Demographics				
Sex, no. (%) female	21 (100)	22 (100)	125 (100)	
Race, no. (%) white	14 (66.7)	13 (59.1)	77 (61.6)	.87
Age, mean (SD), y	39.24 (10.44)	38.27 (12.03)	36.70 (12.04)	.60
BMI, mean (SD), kg/m^2	27.67 (6.02)	27.68 (10.45)	26.93 (7.41)	.86
Single, divorced, or widowed, no. (%)	11 (52.4)	15 (68.2)	74 (59.2)	.57
Some college or higher, no. (%)	15 (71.4)	18 (81.8)	83 (66.4)	.34
Annual income $20,000 or less, no. (%)	11 (52.4)	13 (59.1)	86 (68.8)	.27
Insomnia profile				
Sleep latency, mean (SD), min	54.48 (41.77)	69.73 (51.14)	52.26 (47.19)	.28
Total sleep time, mean (SD), hrs	5.00 (1.37)	5.39 (1.83)	5.53 (1.75)	.42
Sleep efficiency, mean (SD), %	62.10 (20.20)	66.50 (21.88)	71.37 (19.35)	.11
Sleep quality, nightmares, and PTSD				
Nights w/nightmares/week, mean (SD), no.	4.38 (2.04)	4.51 (2.14)	3.86 (2.02)	.27
Nightmares/week, mean (SD), no.	7.29 (5.81)	6.37 (4.44)	6.18 (4.84)	.64
PSQI global score, mean (SD), no.	13.62 (4.58)	14.36 (3.65)	12.48 (3.91)	.08
PSS total score, mean (SD), no.	29.86 (12.95)	30.18 (10.27)	30.62 (11.08)	.95
CAPS total score, mean (SD), no.	79.48 (21.93)	81.86 (23.65)	85.19 (20.91)	.46
Anxiety and depression				
Hamilton Anxiety, mean (SD), no.	25.56 (8.92)	25.95 (7.21)	26.86 (9.05)	.81
Hamilton Depression, mean (SD), no.	25.31 (9.29)	24.75 (7.52)	25.91 (8.97)	.85
Quality of life				
Physical functioning (%)	64.50 (30.34)	62.95 (32.65)	68.83 (26.16)	.57
Role physical (%)	37.50 (42.53)	29.55 (39.06)	42.34 (41.22)	.39
Bodily pain (%)	45.50 (28.27)	43.36 (28.28)	48.52 (25.46)	.65
General health perception (%)	54.40 (25.44)	44.82 (28.41)	47.11 (24.36)	.41
Energy/vitality (%)	29.50 (22.06)	24.32 (18.73)	26.57 (18.65)	.68
Social functioning (%)	50.63 (32.31)	39.77 (24.29)	50.20 (23.43)	.18
Role emotional (%)	20.00 (33.16)	25.75 (34.02)	20.70 (29.94)	.76
Mental health (%)	51.40 (18.18)	56.73 (10.52)	59.10 (12.01)	.04[b]

PSS, PTSD Symptom Scale.
[a] p-value for three-way ANOVAs or 2 × 3 Contigency Coefficient comparing "Objective Testing" to "Refused Testing" to "Unreachable."
[b] "Mental Health" was also the only measure to be statistically different (p = .02) between tested (N = 21) and untested (N = 147).

showed highly significant differences for each outcome measure, all of which showed greater severity in those with SDB, including medium-sized effects (mean d = .56) for insomnia profiles ($F_{4,182}$ = 3.729, p = .006); large effects (mean d = .81) for nightmares, sleep quality, and PTSD symptom severity ($F_{9,177}$ = 3.425, p = .001); large effects (mean d = .73) for anxiety and depression ($F_{2,156}$ = 5.384, p = .005); and large effects (mean d = .76) for impaired quality of life ($F_{8,176}$ = 4.056, p = .000). In the exploratory analysis of SDB presentation type, comparisons between three patient groupings—criterion A (N = 13), criterion B (N = 30), and criteria A and B combined (N = 125)—were highly significant (Table 3), with the combination of sleepiness and insomnia-type presentations (Group AB) reporting worse sleep quality, nightmares, and PTSD symptoms ($F_{9,157}$ = 3.327, $p < .001$), anxiety and depression ($F_{4,276}$ = 4.996, p = .001), and impairment ($F_{16,314}$ = 3.537, $p < .001$) than either sleepiness only (group A) or insomnia-type only (group B). Insomnia profiles for groups AB and B showed patterns of markedly delayed sleep onset (~1 hour) and markedly reduced total sleep time (~5.5 hours) and sleep efficiency (~69%) compared with group A (sleep onset latency = 27 minutes; total sleep time = 6.23 hours; sleep efficiency percentage = 78%); however, this did not attain statistical significance ($F_{6,328}$ = 1.234, p = .29).

Prior Sleep Assessments and Treatments

Among 168 SDB cases, the average age for an initial traumatic event, usually sexual assault, was 11.5 (SD = 9.6) years, corresponding to a mean interval of 25.4 (SD = 13.9) years from this initial trauma to enrollment in the nightmare treatment protocol. Forty-three percent of women reported two or more traumatic events in their lives. The mean chronicity of their sleep problems, defined as nightmare and insomnia complaints, was 21.5 (SD = 14.3) years. Contact with mental health professionals and use of psychotropic medications are detailed in Figure 2 and show that most patients encountered

TABLE 2
Means (SD) and Effect Sizes for Demographic and Outcome Measures in 187 Sexual Assault Survivors With Sleep-Disordered Breathing (SDB) and Without Sleep-Disordered Breathing (No SDB)

	SDB (n = 168)	No SDB (n = 19)	Effect Size[a]
Demographics			
Age (yrs)[b]	37.22 (11.82)	35.42 (11.07)	0.15
BMI (kg/m^2)[b]	27.15 (7.72)	26.35 (6.71)	0.11
Insomnia profile[c]			0.56**
Sleep onset latency (min)[b]	54.82 (47.18)	32.74 (21.95)	0.48*
Total sleep time (hrs)[b]	5.44 (1.72)	6.89 (1.46)	0.83***
Sleep efficiency (%)[b]	69.57 (19.94)	80.05 (16.31)	0.53*
Sleep quality, nightmares, and PTSD[c]			0.81***
Global PSQI[b]	12.87 (4.00)	8.11 (3.00)	1.14***
Nights w/nightmares/week (no.)[b]	4.01 (2.04)	2.52 (1.81)	0.72**
Nightmares/week (no.)[b]	6.34 (4.90)	3.32 (2.27)	0.63**
Total PSS[b]	30.46 (11.16)	20.79 (9.90)	0.85***
Total CAPS[b]	84.04 (21.37)	68.58 (12.42)	0.73**
Anxiety and depression[c,d]			0.73**
Hamilton Anxiety[b]	26.65 (8.75)	20.06 (8.18)	0.74**
Hamilton Depression[b]	25.74 (8.77)	19.36 (7.70)	0.72**
Quality of life[c,e,f]			0.76***
Physical functioning (%)[b]	67.53 (27.51)	83.42 (16.92)	0.59*
Role physical (%)[b]	40.06 (41.09)	65.79 (40.15)	0.62**
Bodily pain (%)[b]	47.47 (26.09)	63.37 (19.27)	0.61*
General health perception (%)[b]	47.69 (25.03)	69.95 (18.58)	0.88***
Energy/vitality (%)[b]	26.63 (19.02)	50.53 (21.53)	1.16***
Social functioning (%)[b]	48.87 (24.84)	67.76 (26.46)	0.74**
Role emotional (%)[b]	21.28 (30.74)	52.63 (39.00)	0.95***
Mental health (%)[b]	57.86 (12.89)	64.63 (9.45)	0.52*

*≤.05; **≤.01; ***≤.001.
[a] Cohen's d = Mean Standard Difference, all denoted with a positive sign indicating greater severity or worse impairment in the SDB group.
[b] ANOVA test and Cohen's d for individual outcomes.
[c] MANOVA test and mean Cohen's d for correlated outcomes.
[d] SDB (n = 141), no SDB (n = 18).
[e] SDB (n = 166), no SDB (n = 19).
[f] Lower Quality of Life scores reflect greater impairment.

two or more providers and had been administered psychotropic medications primarily for distress, although some received specific prescriptions for insomnia. Qualitatively, most patients reported that their prescribing physicians informed them that medicines prescribed for distress would also treat their sleep disturbance.

Few patients had received sleep assessments beyond brief sleep hygiene instructions for insomnia symptoms. Fewer than 9% received cognitive-behavioral instructions or therapy for insomnia or nightmares, and this mostly included eye-movement desensitization and reprocessing for nightmares. Fewer than 5% of patients had ever been referred to a sleep disorders center, and all of these referrals occurred very near to enrollment in the nightmare treatment protocol, (that is, on average, 1 or 2 decades since their sleep problems had begun). Only one patient had been diagnosed with SDB concurrent with enrollment in the nightmare treatment protocol. Throughout multiple encounters with primary care physicians and mental health professionals, the overwhelming majority of patients with SDB reported that they had never received the following: a) a systematic review of their sleep complaints, beyond discussion of basic insomnia and sleep quality symptoms; b) a review of systems focusing on pertinent sleep-related symptoms other than insomnia; c) a physical examination of the oral airway to assess for SDB risks; d) an explanation for their sleep disturbance other than in the context of posttraumatic stress or other psychiatric distress; and e) any standard sleep medicine therapeutic options for sleep disturbance beyond sleep hygiene, medication, or psychotherapy.

Discussion

In this treatment-seeking sample of sexual assault survivors, 90% of women appeared to suffer from a common medical condition, SDB. The presence of diagnosed or suspected SDB was associated with markedly worse sleep, distress, and physical and mental health impairment. The unusual pairing of

TABLE 3
Means (SD) and Effect Sizes for Sleep, Distress, and Impairment Measures by Symptom Presentation Type in 168 Sexual Assault Survivors With Diagnosed or Suspected Sleep-Disordered Breathing

	A Only Sleepy Type (n = 13)	B Only Insomnia Type (n = 30)	A&B Sleepy & Insomnia Type (n = 125)	Effect Sizes Between Pairs of Groups, by Cohen's d[a]		
				A *vs* B	A *vs* A&B	B *vs* A&B
Insomnia profile						
Sleep onset latency (min)	26.69 (20.01)	60.95 (55.93)	56.82 (46.18)	0.73*	0.64*	0.09
Total sleep time (hrs)	6.23 (1.17)	5.57 (1.38)	5.33 (1.82)	0.38	0.52	0.14
Sleep efficiency (%)	78.23 (12.92)	69.20 (17.30)	68.76 (21.00)	0.45	0.47	0.02
Sleep quality, nightmares, and PTSD						
Global PSQI	8.15 (2.85)	11.90 (3.85)	13.59 (3.77)	0.94**	1.36***	0.42*
Nights w/nightmares/week (no.)	2.34 (1.38)	3.44 (1.78)	4.32 (2.05)	0.54	0.97***	0.43*
Nightmares/week (no.)	3.34 (2.13)	5.17 (3.79)	6.94 (5.19)	0.37*	0.73*	0.36
Total PSS	16.54 (9.71)	24.27 (10.88)	33.40 (9.62)	0.69*	1.51***	0.82***
Total CAPS	62.85 (27.36)	76.87 (17.82)	87.97 (19.83)	0.66*	1.18***	0.52**
Anxiety and depression[b]						
Hamilton Anxiety	18.67 (5.55)	25.12 (10.53)	27.97 (8.04)	0.74	1.05***	0.33
Hamilton Depression	17.50 (6.99)	23.00 (8.29)	27.39 (8.41)	0.63*	1.13***	0.50*
Quality of life[c]						
Physical functioning (%)	89.23 (14.84)	76.55 (25.08)	63.15 (27.61)	0.46	0.95***	0.49*
Role physical (%)	59.62 (38.92)	59.48 (45.52)	33.47 (38.37)	0.003	0.64*	0.63**
Bodily pain (%)	69.15 (22.74)	49.03 (25.26)	44.83 (25.69)	0.77*	0.93***	0.16
General health perception (%)	67.38 (21.16)	55.41 (26.61)	43.81 (23.78)	0.48	0.94***	0.46*
Energy/vitality (%)	45.38 (22.12)	36.90 (17.85)	22.26 (19.02)	0.45	1.22***	0.77***
Social functioning (%)	67.31 (23.13)	51.72 (27.49)	46.27 (23.64)	0.63	0.85**	0.22
Role emotional (%)	48.72 (37.56)	36.78 (32.55)	14.78 (26.65)	0.39	1.10***	0.72***
Mental health (%)	65.85 (11.27)	59.72 (9.50)	56.58 (13.44)	0.48	0.72***	0.24

PSS, PTSD Symptom Scale.
*$p < .05$, **$p < .01$, ***$p < .001$.
[a] Cohen's d = Mean Standard Difference.
[b] A Only (n = 12), B only (n = 26), A&B (n = 103).
[c] A Only (n = 13), B only (n = 29), A&B (n = 124).

sleepiness and insomnia complaints was present in the majority with diagnosed or suspected SDB, and this presentation type was also associated with significantly worse sleep, distress, and impairment compared to those with insomnia or sleepiness symptoms only. Qualitatively, these women's sleep problems were treated for an average of 2 decades without apparent access to sleep disorders centers for standard sleep medicine evaluations and therapies. Most patients had been treated within a context that explicated sleep disturbances through the prevailing "psychiatric insomnia" paradigm (*i.e.*, "insomnia related to another mental disorder"; American Psychiatric Association, 1994; Buysse et al., 1994; Nowell et al., 1997). However, insomnia in most patients had not abated despite use of medications and psychotherapy for many years.

SDB is a known cause of insomnia (American Academy of Sleep Medicine, 1999; American Sleep Disorders Association, 1990; Kupfer and Reynolds 3rd, 1997; Morin, 1993), distress (Ford and Kamerow, 1989; Reite, 1998), and impairment (Jenkinson et al., 1997; Smith and Shneerson, 1995). Moreover, SDB appears to be associated with assorted cognitive deficits (Bardwell et al., 1999; Decary et al., 2000), similar to those that have been described in patients with PTSD (Sachinvala et al., 2000), notably those related to attention, concentration, and memory; yet sleep complaints are not typically assessed as primary outcome measures in PTSD treatment studies (Shalev, 2000), nor are they routinely assessed according to AASM practice parameters. To determine the importance and impact of SDB on PTSD, community-based prevalence studies and randomized controlled trials will be required, and we are encouraged by preliminary findings in case series that noted decreases in or elimination of insomnia in patients with PTSD in association with CPAP therapy (Krakow et al., 2000d; Melendrez et al., 2001; Youakim et al., 1998).

Clinically, we are concerned that many primary care physicians and mental health professionals, including psychiatrists, psychologists, and other therapists, may not be aware of certain aspects of the standard sleep history (Dement, 1994) and therefore may not consistently develop a broad differential diagnosis in the assessment of insomnia in PTSD as well as in other psychiatric disorders (Kupfer and Reynolds 3rd, 1997). A reasonable explanation for this lack of attention to a sleep medicine perspective

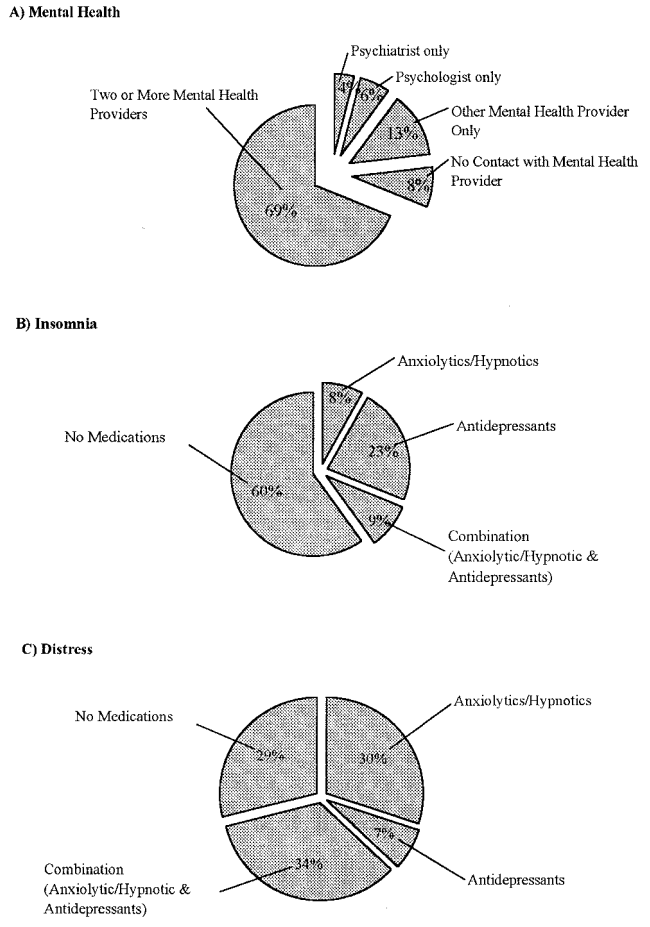

FIGURE 2. Distributions for (A) contact with mental health providers, (B) drugs prescribed for insomnia, and (C) drugs prescribed primarily for distress in 168 sexual assault survivors with presumptive sleep-disordered breathing.

is that most providers may be unaware of the evidence that insomnia could and usually is caused not only by hyperarousal symptoms in PTSD but also by myriad medical and behavioral factors that require precise treatments distinct from or complementary to psychiatric interventions (Krakow et al., 2001c, 2000d; Kupfer and Reynolds 3rd, 1997; Morin, 1993). Identifying a comorbid sleep disorder in PTSD, however, may be difficult for an untrained eye and might account for many trauma patients having their sleep treatment strategies subsumed within a broader distress paradigm. It is therefore understandable that antidepressants or anxiolytic/hypnotics might be initiated to ameliorate sleep complaints (Shalev, 2000) instead of referring patients to sleep disorders centers or sleep specialists. Moreover, anxiolytic/hypnotics and antidepressants appear to be useful in the treatment of insomnia in some PTSD patients (Ballenger et al., 2001; Davidson et al., 2001; Kupfer and Reynolds 3rd, 1997); albeit, to our knowledge, controlled studies have not been conducted using validated sleep instruments and advanced polysomnographic techniques (nasal pressure transducers, esophageal manometry, or EEG spectral analysis) as primary outcome measures to test this hypothesis.

Guidelines from the field of sleep medicine indicate that a rigorous sleep assessment is usually the essential first step prior to prescribing medications for insomnia (Aldrich, 2000; Morin, 1993). Also, sleep medicine practice parameters indicate that nonpharmacologic treatments may have a more sustained impact on chronic insomnia (Chesson et al., 1999). Arguably, patients in this study might have found CPAP an important therapeutic option for the treatment of their sleep disturbance. Moreover, for many trauma patients, we contend that sleep disturbance is better understood as a complex process that requires the integration of numerous therapeutic steps and modalities from the fields of psychiatry and sleep medicine. Collaboration with sleep specialists in a more timely fashion, particularly in nonemergency cases, may ultimately show that the purpose and benefits of medication in the treatment of sleep complaints and sleep disorders among psychiatric patients are more appropriately clarified after a complete sleep medicine evaluation.

Several limitations demand a cautious interpretation of these findings. Patients with pressing sleep complaints may have skewed the sample toward those with obvious medical sleep disorders, thereby raising the possibility of recruitment bias among treatment-seeking trauma patients with nightmares and insomnia. Objective testing in all suspected SDB cases would have been ideal, but this study was initiated too long after patients had completed or withdrawn participation in the earlier nightmare treatment protocol. Also, we could not determine whether or not SDB caused or influenced these physical and mental health symptoms in these trauma patients. Along such lines, the most critical confound is that a comorbid diagnosis of depression might yield a more parsimonious explanation of the findings. Depressed patients with PTSD would be expected to suffer worse sleep, distress, and impairment (Ballenger et al., 2001; Clum et al., 2000; Franklin and Zimmerman, 2001; Kaplan and Klinetob, 2000). Our SDB group averaged severe depression on the HAM-D and suffered worse nightmares, insomnia, sleep quality, distress, and impairment, all consistent with comorbid depression. Perhaps the current construct of SDB also reflects a disguised form of depression, in which case SDB might prove epiphenomenal in these patients. Then again, depression is common in SDB (Millman et al., 1989), and among patients with depression and SDB, several case series have reported decreases or outright reversal of depressive symptoms with CPAP

(Derderian et al., 1988; Millman et al., 1989; Mosko et al., 1989; Yamamoto et al., 2000). Prospective research must address flaws in the current design and more precisely determine the role of SDB in PTSD. A crucial aim of such research must be to scrutinize the overlap between medical sleep disorders (*e.g.*, SDB) and psychiatric disorders (*e.g.*, PTSD and depression) that may have confounded these results. We speculate that future studies examining hypotheses generated from this pilot work will discover a salient clinical interaction in a meaningful but as yet unknown proportion of PTSD patients with comorbid SDB.

In conclusion, this pilot study suggests that SDB was widespread among this sample of sexual assault survivors with posttraumatic stress symptoms and was strongly associated with worse sleep, distress, and impairment. Although replication and clarification of these results are needed, some trauma patients are likely to benefit from attempts to understand and evaluate their sleep complaints through sleep medicine practice parameters. To facilitate care, polysomnography, preferably with advanced respiratory assessment technology, needs to be considered as an essential and early step in the assessment of appropriate patients. As applicable, standard sleep medicine therapies, now available throughout the United States, need to be regarded as potential first-line therapies for trauma patients with diagnosable sleep disorders.

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