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Manifestations of Insomnia in Sleep Apnea: Implications for Screening and Treatment

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The aims of this study were to examine the presence, type, and severity of insomnia complaints in obstructive sleep apnea (OSA) patients and to assess the utility of the Sleep Symptom Checklist (SSC) for case identification in primary care. Participants were 88 OSA patients, 57 cognitive-behavioral therapy for insomnia (CBT-I) patients, and 14 healthy controls (Ctrl). Each completed a sleep questionnaire as well as the SSC, which includes insomnia, daytime functioning, psychological, and sleep disorder subscales. Results showed that OSA patients could be grouped according to 3 insomnia patterns: no insomnia (OSA), n = 21; insomnia (OSA-I), n = 30, with a subjective complaint and disrupted sleep; and noncomplaining poor sleepers (OSA-I-NC), n = 37. Comparisons among the OSA, CBT-I, and Ctrl groups demonstrate distinct profiles on the SSC subscales, indicating its potential utility for both case identification and treatment planning.

Obstructive sleep apnea (OSA) presents two important challenges for primary care. First, OSA is underrecognized in general medical practice. Prevalence rates for sleep apnea are reported to range from 10% to 40% in the general population, the higher prevalence accruing to more susceptible populations, such as community-dwelling older adults (Ancoli-Israel et al., 1991; Johansson, Alehagen, Svanborg, Dahlström, & Broström, 2009). Symptom presentation is highly variable and includes complaints of poor sleep, insomnia, poor daytime functioning, and psychological distress in addition to the "classic" signs of daytime sleepiness and loud snoring, thereby hindering the recognition and referral process. Yet there is evidence that untreated OSA has a negative impact on cardiovascular mortality in the elderly and that treatment may reduce this risk (Martínez-García et al., 2012).

Once OSA is diagnosed, the second challenge is that treatment adherence is disappointingly low. The most prescribed therapy, positive airway pressure (PAP), which has proven efficacy for many patients, has an adherence rate of about 50% after 30 months of initiating therapy (Grote, Hedner, Grunstein, & Kraiczi, 2000; Wolkove, Baltzan, Kamel, Dabrusin, & Palayew, 2008). In addition, recent studies suggest that about 40–60% of patients with diagnosed sleep apnea also report insomnia symptoms (Björnsdóttir et al., 2012; Fichten et al., 2013; Hagen, Patel, & McCall, 2009; Krell & Kapur, 2005; Lavie, 2007; Lichstein, Justin Thomas, Woosley, & Geyer, 2013; Luyster, Buysse, & Strollo, 2010). This association has raised the possibility that comorbid insomnia or sleep disruption may have an important negative impact on the success of OSA treatment.

The complaint of insomnia is also highly prevalent in primary care (Simon & VonKorff, 1997), though patients tend to underreport their symptoms (Bailes et al., 2009). A study of primary care patients with no known history of OSA found that 50% of the sample endorsed at least one symptom of both sleep apnea and insomnia (Krakow, Ulibarri, Romero, & McIver, 2013). Another sample in this study, of patients who already had a diagnosis of OSA, endorsed a high rate of insomnia.

With the goal of better recognizing sleep apnea in primary care, we developed a short self-report questionnaire allowing patients and their doctors to review a wide range of sleep-related symptoms to determine whether a referral to a sleep clinic would be beneficial. The Sleep Symptom Checklist (SSC; Bailes et al., 2008; Bailes et al., 2009) has potential to be used as a screening tool in primary

care that could enhance case finding. In addition to its focus on sleep apnea, the symptom items were found to group into insomnia, daytime, and psychological symptom factors. Therefore, we believe that the SSC may provide a more detailed profile of sleep apnea risk that includes coexisting disorders, such as insomnia, that may impinge on treatment effectiveness.

The aim of the present investigation is to examine the presence, type, and severity of comorbid insomnia complaints in OSA patients using the SSC. This study represents a secondary analysis in a sample of older patients recruited from family practice waiting rooms. The presence of sleep apnea had not been suspected prior to their participation. It offers another perspective on prior research findings on the comorbidity of OSA and insomnia. These findings are largely based on sleep clinic samples, that is, patients whose symptom presentation was perhaps striking enough to suspect a sleep disorder. In addition, we included a contrast group of individuals with low likelihood of OSA who were seeking cognitive-behavioral therapy for chronic insomnia (CBT-I), as well as a healthy control group.

In general, our goal was to advance the understanding of OSA symptom profiles in order to improve the rate and speed of diagnosis of primary care patients with OSA as well as to enhance subsequent treatment planning. This study was, therefore, primarily descriptive. Specifically, we expected to find that, in an OSA sample of older patients recruited directly from family practice, there would be a significant presence of insomnia complaints, as previously reported for sleep clinic patients and for Krakow et al.'s (2013) sample of family practice patients. Further, we expected to find that the subscales of the SSC would show identifiable response patterns among the OSA, CBT-I, and control groups, thus developing the measure's utility for case-finding.

METHODS

Participants

The total number of participants was 159, including 88 primary care patients recently diagnosed with OSA, 57 patients seeking cognitive-behavioral therapy for insomnia (CBT-I), and 14 community participants with no sleep problems, that is, No insomnia, No OSA (Controls).

All 88 OSA participants were part of a large research program on screening for sleep apnea in older, primary care patients; and their inclusion in the present study represents a secondary analysis. Consecutive, eligible participants had been referred to the program by their family doctor. Patients were included if they were aged 45 and older, male or female, able to complete a set of questionnaires in English or French, and willing to spend one night in a sleep laboratory. Patients were excluded by their family doctor if they were currently experiencing a severe medical or psychiatric disorder. For the present study, subjects were included if they had an apnea/hypopnea index or respiratory disturbance index (AHI/RDI) of 10 or greater and were excluded if they, in addition, reported restless legs syndrome (RLS) or if their polysomnogram showed evidence of periodic limb movement disorder (PLMD).

The CBT-I group consisted of consecutive patients seeking cognitive-behavioral treatment for insomnia at a hospital-based CBT clinic. The majority (80%) were referred from sleep clinics (having tested negative for other sleep disorders) while the remainder were self-referred. Those with known sleep apnea, RLS, or PLMD were excluded from the present analysis. The inclusion of

the CBT-I group was retrospective: We obtained permission from the Jewish General Hospital Research Ethics Board for a chart review.

Control participants were community volunteers who were screened for sleep apnea using a home monitoring device as part of another study. The device is described in the Measures section below.

Measures

All participants completed questionnaire batteries associated with their respective studies. In common with all studies, patients in each group provided a list of their current medication and recent medical history and completed the Sleep Study Checklist (SSC), and a sleep questionnaire.

Sleep apnea diagnosis for the OSA group was established using overnight polysomnography in an American Academy of Sleep Medicine (AASM) board-certified sleep laboratory. The control group was screened for OSA using home sleep oximetry recording, reviewed and validated by an AASM board certified sleep specialist. In order to establish OSA/insomnia subgroups, we used the Sleep Questionnaire to establish an insomnia diagnosis. Comparisons among these subgroups were performed on the other questionnaire measures.

Polysomnography (PSG)

Nocturnal PSG was used to obtain sleep parameter scores (i.e., frequency of nocturnal arousals, total sleep time, sleep onset latency, wake after sleep onset, and sleep efficiency) as well as sleep apnea-related factors (i.e., nocturnal profile of oxygen saturation [O2%], apnea-hypopnea index [AHI] and respiratory event-related arousal from sleep). Participants were monitored in a supervised sleep laboratory from 10:00 p.m. to 7:00 a.m. Monitoring included: electrooculargram (EOG), electroencephalogram (EEG), bilateral anterior tibialis and chin electromyogram (EMG), electrocardiogram (ECG), pulse oximetry, nasal and oral airflow with thermistor and nasal pressure cannulae, microphone for snoring, end-tidal CO_2 monitoring, and respitrace bands for measurement of respiratory effort. Apnea events and associated arousals were scored manually according to scoring rules established by the American Academy of Sleep Medicine (Iber, Ancoli-Israel, Chesson, & Quan, 2007). An apnea event was defined as cessation of breathing lasting 10 s or more. Hypopneas were scored when there was a 30% or more decrease in airflow with 3% or more oxygen desaturation or a subsequent cortical arousal. Scoring sleep began at lights out and stopped when the participant arose in the morning.

Home sleep oximetry assessment

Healthy control group participants underwent home sleep recording to screen for the presence of sleep apnea. This was performed with a SnoreSat Recorder (SegaTech Electronics Inc., Calgary, Canada). This device has been compared to overnight polysomnography and found to provide a close estimate of the apnea-hypopnea index (AHI) as well as excellent diagnostic sensitivity and specificity for obstructive sleep apnea (OSA) in a sample of patients with suspected OSA (Torre-Bouscoulet, 2007; Vázquez et al., 2000). This device records pulse oximetry, nasal airflow with nasal pressure cannulae, microphone for snoring, and respitrace bands for measurement of respiratory effort. Respiratory disturbance indices were adjusted for any time spent with invalid recording or persistent movement suggesting wakefulness. Records

underwent automated scoring, which was reviewed by visual inspection of the raw data, disclosed in 10-min epochs, by a board-certified sleep specialist physician. The automated scoring was found to be reliable. No further manual scoring was undertaken, and the automated scores were not changed. The screening protocol identified two potential control participants who were found to have previously unsuspected sleep apnea. They were referred for further sleep evaluation and treatment and excluded from the present study.

Sleep Symptom Checklist (SSC)

The SSC (Bailes et al., 2008) is a 21-item survey of a broad range of symptoms that are both directly and indirectly related to sleep disorders. It is easily completed by older patients. The respondent rates each symptom for its severity from 0 (not at all) to 3 (very severe) based on the previous month. Temporal stability of the severity ratings was found to be acceptable (total score $r = 0.79$, $p < .01$). Cronbach's alpha was 0.74. Factor analysis yielded four distinct subscales: Insomnia, Daytime Distress, Sleep Disorder, and Psychological Maladjustment, accounting for 52% of variance. Temporal stability of the subscales according to test-retest correlations on the sums of the severity ratings for each subscale of the convenience sample ($n = 21$) ranged from 0.77 (Daytime Distress) to 0.85 (Sleep Disorder). The subscales and related symptom items are presented in the appendix.

Sleep questionnaire

In accordance with established practice, self-report rather than PSG was used to diagnose insomnia (Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008). It is a brief retrospective measure (Alapin et al., 2002; Fichten et al., 1995) that inquires about typical nocturnal and daytime (e.g., fatigue, sleepiness, difficulty concentrating) experiences during the past month and the frequency (0–7 days/week) of Non-Refreshing Sleep, Difficulty Falling Asleep and getting back to sleep after nocturnal awakenings, as well as about the typical duration of sleep onset latency (SOL) and the duration of wake after sleep onset (WASO). The measure also asks about the presence (yes/no) and the duration of the sleep problem as well as distress related to it. The information provided allows us to diagnose the presence or absence of difficulty initiating or maintaining sleep (DIMS) in accordance with typically used research criteria (i.e., at least 31 min of undesired awake time at least 3 times per week with a problem duration of at least 1 month and a complaint of an insomnia problem; Edinger et al., 1996; Fichten, Libman, Bailes, & Alapin, 2000; Lichstein, Durrence, Taylor, Bush, & Riedel, 2003; Lichstein, Riedel, Lester, & Aguillard, 1999; Lichstein et al., 2006).

The Sleep Questionnaire has been validated in both English and French in our research. For example, data indicate good test-retest reliability for the Sleep Questionnaire items: r values range from .58 to .92 for intervals ranging from 2 weeks to 15 months (Fichten et al., 1995). High correlations between equivalent scores on this measure and on the Sleep Diary were also found (e.g., r = .83, .64, and .69 for TST, SOL, and WASO, respectively; Libman, Fichten, Bailes, & Amsel, 2000).

Ethics

The OSA group belonged to a large screening study granted ethics approval by the McGill University Institutional Review Board (IRB), the Jewish General Hospital (Montreal) research ethics committee (REC), and the St. Mary's Hospital (Montreal) Research Ethics Board. All participants gave informed, signed consent. The CBT-I group's participation was approved by the Jewish General Hospital's REC as a retrospective chart review. The Control group's participation was approved by the Jewish General Hospital's REC. Though this study is a secondary analysis, the statistical analyses are consistent with those approved by the ethics boards. Only subgroup comparisons are original to the present study.

RESULTS

Segregation of Sleep Apnea Participants Into Insomnia and No-Insomnia Subgroups

In accordance with established practice, self-report rather than PSG was used to diagnose difficulty initiating or maintaining sleep (DIMS) and insomnia (Schutte-Rodin et al., 2008). Insomnia in the research literature is defined as DIMS, including at least 31 min of undesired awake time at least 3 times per week with problem duration of at least 1 month (Edinger et al., 1996; Fichten et al., 2000), coupled with a complaint of insomnia. Notably, DIMS can be reported without a complaint of insomnia. For the present study, we define the "complaint" of insomnia to be a "yes" response to the question: "Do you have insomnia?" Duration is based on a question asking about the duration of a DIMS problem. For the DIMS portion we used the Sleep Questionnaire's frequency (at least 3 times per week) and duration ratings of difficulty falling asleep (over 30 min) or difficulty maintaining sleep (i.e., over 30 min of undesired wake time after sleep onset) at least 3 times per week. Using the Sleep Questionnaire, participants with the diagnosis of sleep apnea were categorized according to their acknowledgement or denial of the presence of insomnia (Do you have insomnia? Yes, No) and the presence or absence of DIMS (i.e., either SOL or WASO greater than 30 min at least 3 times per week). Among the sleep apnea participants, we identified an OSA group (n = 21), which neither acknowledged insomnia nor provided evidence of DIMS, and an OSA-I group (n = 30), which acknowledged both insomnia and DIMS. We also found a substantial group who denied the presence of insomnia (i.e., not complaining) but reported DIMS (OSA-I-NC, n = 37). These are similar to the group of noncomplaining poor sleepers identified in a previous study (Fichten et al., 1995). The final composition of the groups is included in Table 1.

Sample Characteristics

The gender and age composition of each sample is presented in Table 1. A chi-square test of association, carried out to test gender distribution across the five samples, was significant, χ^2 = 14.1, df(4), $p < .01$, suggesting that the gender distribution was not even across the groups. A one-way ANOVA comparing age among the 5 groups showed a significant effect, F(4,154) = 5.92, $p < .0$l. Consequently, most of the following comparisons among the 5 groups included age and gender as covariates.

TABLE 1
Sex and Mean Ages for Sleep Apnea (OSA, OSA-I-NC, OSA-I), CBT-I, and Control Participants

	Sample Ns		
	Women	*%*	Mean age (SD)
OSA	8/21	38.1	55.86 (10.00)
OSA-I-NC	17/37	45.9	59.08 (12.98)
OSA-I	16/30	53.3	53.70 (9.83)
CBT-I	40/57	70.2	46.38 (16.50)
Control	12/14	85.7	49.07 (8.62)
Total	93/159	58.5	52.21 (14.06)

Table 2 presents the laboratory findings for the 3 sleep apnea groups (OSA, OSA-I, OSA-I-NC). A one-way multivariate analysis of covariance (MANCOVA) was conducted comparing the 3 groups on BMI and 5 polysomnography variables (Respiratory Arousals, Apnea/Hypopnea Index, Sp02 [Average and Minimum]) with age and gender as covariates. There was no significant main effect of Group, Wilks's lambda = 0.942, $F(10,150) = 0.456$, n.s. This demonstrates that the groups did not differ in body mass (BMI) or in sleep apnea severity.

Comparison of OSA, OSA-I, OSA-I-NC, CBT-I, and Controls on SSC Subscales

A one-way multivariate analysis of covariance (MANCOVA) was conducted comparing five groups on the 4 SSC subscales (Insomnia, Daytime Functioning, Sleep Disorder, Psychological Distress) with age and gender as covariates. Neither age nor gender showed a significant main

TABLE 2
Means (Unadjusted) and Standard Deviations and ANOVA Tests for BMI and Polysomnography Indices for 3 OSA Groups

Lab measure		*n*	*Mean*	*SD*	*df*	*F*	
Body Mass Index (BMI)	OSA	20	31.45	5.8	2(83)	1.20	ns
	OSA-I-NC	36	29.59	6.3			
	OSA-I	30	28.74	6.0			
Respiratory Arousals	OSA	20	40.92	22.2	2(83)	.486	ns
	OSA-I-NC	36	38.52	26.1			
	OSA-I	30	34.04	26.6			
Respiratory Events: AHI	OSA	20	30.38	20.0	2(82)	.240	ns
	OSA-I-NC	36	32.49	28.2			
	OSA-I	29	27.93	27.7			
SpO2 Mean	OSA	20	96.17	1.7	2(83)	.384	ns
	OSA-I-NC	26	96.23	1.9			
	OSA-I	30	96.55	1.5			
SpO2 Minimum	OSA	20	83.45	9.9	2(82)	.340	ns
	OSA-I-NC	35	86.02	6.9			
	OSA-I	30	84.19	17.1			

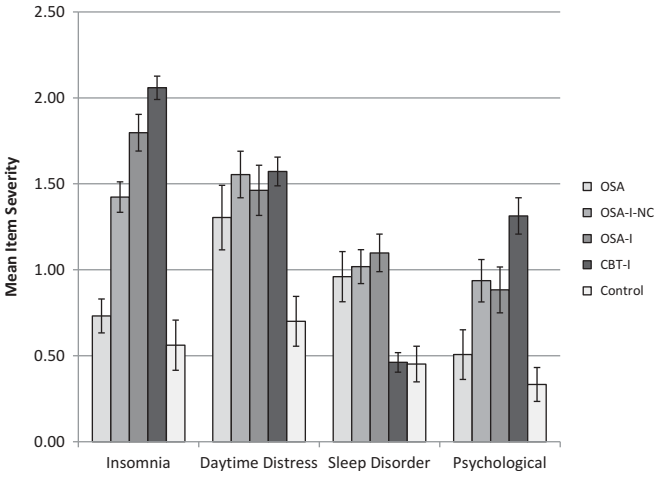

FIGURE 1 Means (unadjusted) and standard errors of severity ratings for four SSC subscales for five groups. Subscale means are divided by the number of subscale items.

effect. There was a significant main effect of Group, Wilks's lambda = 0.31, $F(15,397) = 11.74$, $p < .001$. Next, one-way ANOVAS and Bonferroni post-hoc comparisons were carried out comparing the 5 groups on each of the 4 SSC subscales. Unadjusted SSC mean scores (i.e., divided by the number of subscales items) and standard errors for the five groups are presented in Figure 1.

The post-hoc comparisons reveal distinct patterns of subscale responses for each group. Overall, the groups who have diagnosed sleep apnea (OSA, OSA-I, and OSA-I-NC) score significantly higher on the Sleep Disorder subscale than the two groups without sleep apnea (CBT-I, Control). On the Insomnia subscale, the groups behave in a predictable manner: those with diagnosed insomnia (CBT-I, OSA-I) have significantly higher scores than the other groups. The nondistressed poor sleepers (OSA-I-NC) have a higher Insomnia subscale score than the OSA and Control groups, but lower than the CBT-I or OSA-I groups. All clinical groups (sleep apnea or insomnia) have higher Daytime Distress scores than the control group. The CBT-I group had higher Psychological Distress scores than the OSA and Control groups.

Comparison of OSA, OSA-I, OSA-I-NC, CBT-I and Controls on Selected Sleep Questionnaire Items

We include comparisons of Sleep Questionnaire items partly as validation of the SSC results and partly to have a more detailed picture of the sleep profiles of these groups. A one-way MANCOVA was conducted comparing five groups on 14 Sleep Questionnaire items with age and gender as covariates. There were no significant main effects of age or gender. There was a significant main effect of Group, Wilks's lambda = 0.144, $F(60,373.060) = 3.99$, $p < .001$. Next, one-way univariate ANOVAS and post-hoc comparisons were carried out comparing the five groups on Sleep Questionnaire items. Unadjusted means, standard deviations, F statistics, and Bonferroni post-hoc comparisons are presented in Table 3.

TABLE 3
Means (Unadjusted), *SD*s for 5 (Group) x 14 Sleep Questionnaire Items, ANOVA, and Post-Hoc Comparisons (Bonferroni Adjusted)

Sleep questionnaire item	*OSA*	*OSA-I-NC*	*OSA-I*	*CBT-I*	*Control*	*df*	*F*	*p*	*Post-hoc*
Insomnia Distress (10 = high distress)	1.09 (1.9)	4.08 (2.6)	5.93 (2.9)	8.34 (1.8)	1.93 (2.0)	6(146)	39.27	***	CBT-I > OSA-I > OSA-I-NC> OSA, Ctrl
Insomnia Duration (Months)	1.50 (6.7)	63 (102)	116 (102)	120 (144)	10 (20)	6(132)	4.20	**	CBT-I, OSA-I > OSA
Sleep Onset Latency (Hours)	0.26 (.16)	1.00 (1.1)	1.28 (1.1)	1.25 (1.0)	0.39 (.29)	6(139)	4.51	***	CBT-I, OSA-I, OSA-I-NC> OSA
Waking After Sleep Onset (Hours)	0.18 (.17)	1.29 (.74)	1.75 (.81)	1.56 (1.6)	0.46 (.81)	6(138)	6.62	***	OSA-I, CBT-I > OSA, Ctrl; OSA-I-NC> OSA
Total Sleep Time (Hours)	7.20 (1.3)	5.99 (1.6)	5.63 (1.6)	4.84 (1.5)	7.36 (.99)	6(145)	10.07	***	Ctrl, OSA > CBT-I, OSA-I; OSA > OSA-I-NC
Sleep Medications (Per week)	0.35 (1.5)	1.03 (2.2)	2.28 (3.1)	3.38 (3.1)	0.00 (00)	6(145)	9.80	***	CBT-I > OSA, OSA-I-NC, Ctrl; OSA-I > OSA
Sleep Quality (10 = very good)	6.48 (2.1)	4.78 (2.4)	4.65 (1.8)	3.39 (1.8)	8.11 (1.6)	6(146)	13.25	***	Ctrl, OSA > OSA-I-NC, OSA-I, CBT-I
Sleep Satisfaction (10 = very good)	6.14 (22)	4.35 (2.5)	4.00 (1.7)	2.42 (1.2)	7.75 (1.7)	6(146)	20.00	***	Ctrl, OSA > OSA-I-NC, OSA-I > CBT-I
Refreshed in the Morning (10 = very)	4.90 (3.5)	4.11 (2.6)	4.33 (1.9)	3.05 (1.5)	6.93 (2.5)	6(146)	5.87	***	Ctrl, OSA > CBT-I; Ctrl > OSA-I, OSA-I-NC
Tension falling asleep (10 = very tense)	3.76 (2.6)	3.51 (2.1)	4.17 (2.4)	6.37 (2.5)	4.57 (3.2)	6(146)	7.31	***	CBT-I > OSA, OSA-I, OSA-I-NC
Tired during the day (10 = very tired)	5.71 (2.3)	6.27 (2.3)	5.77 (2.0)	6.78 (2.2)	3.36 (1.9)	6(148)	5.54	***	CBT-I, OSA-I-NC, OSA-I, OSA > Ctrl
Sleepy during the day (10 = very sleepy)	5.14 (2.4)	5.45 (2.8)	4.80 (2.3)	4.82 (2.5)	2.43 (1.8)	6(146)	3.52	**	OSA-I-NC, OSA, OSA-I, CBT-I > Ctrl
Difficult to concentrate (10 = very)	3.69 (2.8)	4.92 (2.7)	5.17 (2.5)	5.68 (2.5)	2.07 (1.3)	6(148)	5.69	***	CBT-I, OSA-I, OSA-I-NC> Ctrl
Naps (days per week)	2.38 (2.9)	2.11 (2.5)	1.49 (1.9)	0.99 (1.6)	0.78 (1.2)	6(146)	2.66	*	ns

*$p < .05$, **$p < .005$, ***$p < .001$.

These analyses tend to validate those carried out for the SSC items in that the OSA group reports a similar pattern of sleep parameters as the Control group, but a similar pattern of daytime functioning as the insomnia groups. Moreover, the CBT-I group and the sleep apnea groups report similar daytime impairment. The OSA-I-NC group, of course, reports less distress from an insomnia problem than the other insomnia groups, but has other similarities in objective sleep parameters.

DISCUSSION

Comorbidity of OSA and Insomnia

Consistent with recent reports (Björnsdóttir et al., 2012; Hagen et al., 2009; Krakow et al., 2013; Krell & Kapur, 2005; Lavie, 2007; Lichstein et al., 2013; Luyster et al., 2010), and our first hypothesis, the present study finds an important presence of poor sleep and insomnia in patients diagnosed with sleep apnea. Seventy-six percent of OSA patients endorsed DIMS symptoms and 38% meet criteria for a diagnosis of insomnia. Furthermore, participants with sleep apnea could be differentiated into three clinically distinct entities: those with no definable sleep DIMS or insomnia (OSA), those who met the criteria for insomnia (i.e., complaint of insomnia and DIMS: OSA-I), and those who met the criteria for DIMS but did not complain of insomnia (OSA-I-NC). Notably, there were no significant differences among the three groups on indices of the severity of sleep apnea.

The emergence of the nondistressed poor sleeper subgroup (OSA-I-NC), while unexpected in a sleep apnea sample, has been encountered in our previous research on nondistressed poor sleeper older adults (Fichten et al., 1995; Fichten et al., 2000). It is also important to note that we found a significant subset of sleep apnea patients (OSA: approximately 25%) who have no self-reported insomnia symptoms and are indistinguishable from the control group except for their apnea-related symptoms.

In the present study, other than the acknowledged endorsement of insomnia, the two sleep apnea subgroups with DIMS symptoms, OSA-I and OSA-I-NC, show no substantial differences on daytime functioning, sleep parameters, or psychological functioning, except that the latter are less distressed about their sleep. We believe that the distinction between poor sleepers who complain of insomnia and those who do not is important and deserves further study. It is possible that the uncomplaining group would receive less clinical attention for their sleep disturbance. If they do not acknowledge an insomnia problem, one must, nevertheless, determine whether their DIMS has an impact on adherence to their sleep apnea treatment if their poor sleep is not addressed.

Identification of Sleep Apnea Symptom Profiles for Screening and Treatment

An important outcome of the present study, and related to our second hypothesis, has to do with the utility of the SSC as a quick and effective means of identifying these groups in a clinical setting. OSA patients were clearly distinguished from chronic insomnia patients by means of their SSC profile. It is noteworthy that none of the clinical groups (i.e., sleep apnea and insomnia) was distinguishable on the basis of reported daytime experience; all endorse feeling sleepy, fatigued, or nonrefreshed. Moreover, OSA patients are distinguishable on the Insomnia subscale of the SSC, whether they complain of insomnia or not. An

understanding of the ways that insomnia and sleep complaints coexist with sleep apnea is important since they can potentially interfere with both identification of sleep apnea risk in primary care as well as treatment. However, because our groups were selected, not all possible patient types are represented here, for example, patients with other sleep disorders such as periodic limb movement disorder or with a history of severe cardiovascular disease such as heart failure. Further research is needed to validate the potential of the SSC to identify these apnea/insomnia subgroups among unselected patients in primary care settings.

Limitations

While we believe that this study yielded some important findings, it suffers from the methodological limitations inherent in secondary analyses. Principally, in this case, the OSA, CBT-I, and control participants were recruited from different settings, sleep apnea diagnostic testing differed among groups, and group sample sizes were variable and, in some cases, small. These findings warrant replication and further validation of the symptom profiles in a primary care population using a uniform methodology.

Importance of OSA and Insomnia Recognition and Treatment

Both OSA and insomnia are important risk factors for cardiovascular disease (Gottlieb et al., 2010; Marin, Carrizo, Vicente, & Agusti, 2005; Sutton, Moldofsky, & Badley, 2001), hypertension (Lanfranchi et al., 2009; Pedrosa et al., 2011), and blood glucose regulation (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Pamidi, Aronsohn, & Tasali, 2010). In future research, it will be important to tease apart the relative contributions of sleep apnea and insomnia to disease incidence and severity. Moreover, the rapid identification of apnea and insomnia subtypes is extremely important clinically, and there is an acute need for efficient, validated measures for use in primary care to guide referral and treatment.

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APPENDIX.
Subscales and Items of the Sleep Symptom Checklist (SSC).

Sleep Symptom Checklist
Insomnia Subscale
Waking up and trouble getting back to sleep
Insomnia
Trouble falling asleep
Poor sleep quality
Waking up too early in the morning
Waking often to urinate
Daytime sleepiness
Daytime Distress Subscale
Lack of vitality
Bodily pain
Daytime fatigue
Limited in doing things because of health
Sleep is non-refreshing
Sleep Disorder Subscale
Waking with a dry mouth
Snoring
Interruption of breathing during sleep
Parts of body jerk at night
Falling asleep during the day when not wanted
Waking with a headache
Psychological Distress Subscale
Depression
Poor emotional well-being
Anxiety