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SLEEP BREATHING PHYSIOLOGY AND DISORDERS • ORIGINAL ARTICLE

Prevalence of potential nonallergic rhinitis at a community-based sleep medical center

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Abstract
Purpose Nonallergic rhinitis (NAR) is a common condition involving symptomatic nasal congestion, stuffiness, or rhinorrhea, which overlap with symptoms of allergic rhinitis. Scant research has examined NAR and sleep. The aim of this study was to assess the frequency of potential NAR symptoms in a large sample of sleep center patients.
Methods A retrospective chart review was conducted on 2658 adult patients at our sleep center from 2008 to 2012; 1703 reported clinically relevant nasal congestion. For this subset, potential NAR status (NAR+ vs NAR−) was determined using a brief survey. NAR groups were further divided into three subgroups based on presenting chief complaints: insomnia (INS), nonrestorative sleep (NRS), and sleep-disordered breathing (SDB). Patients objectively diagnosed with SDB were also analyzed by NAR status. Validated scales for sleepiness, insomnia, anxiety, and depression were compared among the groups.
Results Potential NAR+ comprised 70 % (1194 of 1703) of patients with congestion and showed significantly higher congestion scores than NAR− status [11.97 (3.62) vs 10.47 (3.37); $p = .001$; $g = 0.42$; 95 % CI, 0.32–0.53]. The proportion of potential NAR+ cases for each presenting chief complaint was nearly identical (range 69.6 to 71.2 %). However, the comparison of effects between NAR+ and NAR− cases within each presenting group (INS, NRS, SDB) was more consistently significant on the scales for insomnia, sleepiness, anxiety, and depression only in the SDB category. The same four symptoms, measured in those objectively diagnosed with SDB, were also significantly worse in NAR+ compared to NAR− patients.
Conclusions Regardless of presenting chief complaint and ultimate diagnosis of sleep-disordered breathing, potential nonallergic rhinitis was common in patients at a sleep medical center at a rate possibly greater than twice that reported in the general population. Potential NAR+ was associated with worse sleep and distress symptoms. In both prevalence and treatment studies, research must further evaluate the potential impact of NAR on specific sleep disorders.

Keywords Nonallergic rhinitis · Allergic rhinitis · Sleep-disordered breathing · Insomnia · Nonrestorative sleep

Introduction

Among the common rhinitides, seasonal allergic rhinitis (SAR) and perennial allergic rhinitis (PAR) appear to be the most recognizable by patients and providers [1], whereas perennial nonallergic rhinitis (NAR), though common in adults, is less discernible [2]. Despite overlapping symptoms in these rhinitides, including nasal congestion, stuffiness, or rhinorrhea [1], NAR appears to reflect a different disease process either due to external stimuli distinct from those observed in SAR and PAR or due to actual pathology within the nasal system involving neurosensory abnormalities [3, 4, 5]. Anatomic sites of obstruction, e.g., septal deviation or nasal polyps, may also factor in the rhinitides [6]. According to some studies, 7 to 19 % of the adult population suffers from NAR [3, 7]. Other research suggests the prevalence of nonallergic rhinitis is unknown, mainly due to the overlap in symptoms between AR and NAR [8, 1, 9, 10].

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Despite the broad prevalence of these rhinitides and a fair amount of research on SAR and PAR with respect to effects on sleep [11, 12] and sleep-disordered breathing [13], there is a lack of literature on the impact of NAR on sleep. In fact, articles on the topic of NAR and sleep or NAR and sleep-disordered breathing are virtually nonexistent [14]. This void is perplexing in light of studies demonstrating not only a generalized improvement in quality of life metrics and productivity with the use of topical nasal steroids in patients complaining of poor sleep [12], but also a decrease in apnea-hypopnea index (AHI) with the use of topical nasal steroids for the treatment of seasonal or perennial rhinitis among patients with either obstructive sleep apnea (OSA) or nonapneic snoring [likely upper airway resistance syndrome (UARS)] [15, 13].

In the arid southwestern USA, year-round symptoms of congestion are more likely due to nonallergic rhinitis given the paucity of perennial antigens (no dust mites, few perennial molds), albeit perennial rhinitis due to animal allergies may also occur [16]. In our sleep clinic experience in New Mexico, we are impressed with the high prevalence of mixed rhinitides, especially potential NAR symptoms in treatment-seeking patients, regardless of whether their primary complaint was related to sleep breathing, insomnia, or nonrestorative sleep. In related clinical experience, we often observe greater reports of NAR symptoms in patients presenting with psychiatric distress symptoms of anxiety or depression.

As part of our intake process, patients complete a nasal assessment based on sleep surveys as well as clinical encounters to differentiate allergic-predominant and nonallergic-predominant conditions. These distinctions are important since recent research shows broadening and diverging treatment options for the rhinitides [8]. Most importantly, some patients participating in a basic nasal hygiene program report improved nasal patency and immediate sleep gains [17]. Specific to nonallergic rhinitis, we are impressed with treatment options that demonstrate surprisingly large therapeutic effects among a cohort of patients who previously reported no relief from other therapies [18, 19].

To assess potential NAR (or mixed rhinitis) and sleep, we conducted a retrospective chart review of this symptom cluster in treatment-seeking patients presenting to a community-based, sleep medical center. We developed three hypotheses:

- Potential NAR would be common with rates greater than estimated rates in the general population.
- Potential NAR would be equally prevalent in those presenting with chief complaints of insomnia, nonrestorative sleep, and sleep-disordered breathing.
- Potential NAR would be consistently associated with worse sleep and mental health symptoms compared to patients without NAR in the cohort presenting with a sleep breathing complaint and among those testing positive for OSA or UARS.

Methods

Consent and inclusion criteria

This retrospective chart review was approved by the Los Alamos Medical Center Institutional Review Board, Los Alamos, NM. All patients presented to Maimonides Sleep Arts & Sciences (MSAS) in Albuquerque, NM and completed the standard MSAS online intake process, including sleep medical, past medical, and psychiatric histories. The patients also ranked their presenting chief complaint including insomnia (INS), nonrestorative sleep (NRS), sleep breathing problem (SDB), or other less common conditions. Inclusion criteria were as follows: (1) completed web-based intake survey, including the questions targeting symptoms of nasal congestion, and (2) 18 years of age or older.

Subjective measures

A nonvalidated survey of eight questions assessed frequency of general congestion and nonallergic rhinitis symptoms scored on a 5-point Likert scale (0 = never, 1 = rarely, 2 = occasionally, 3 = frequently, 4 = always) (Fig. 1). Five questions target general symptoms of congestion, stuffiness, and rhinorrhea (CSR) and their specific timing during the day and night. Patients with a total CSR score ≥6 qualified as CSR+; total scores <6 were CSR− and excluded from the study. The three remaining questions target potential nonallergic rhinitis symptoms and triggers, i.e., stuffiness or rhinorrhea aggravated by changes in wind, weather, or temperature. CSR+ patients with a total NAR score ≥4 were NAR+ (potential NAR); CSR+ patients with total scores <4 were NAR−. Inclusion cutoffs reflect a symptom frequency of at least occasional or greater.

An important caveat must be noted; no attempt was made to definitively establish specific conditions or mixed rhinitides in these patients, which would have required a much more extensive evaluation as is standard in the field of allergy and immunology (e.g., environmental exposure chamber, nasal anatomy examination, skin testing, etc.) [20, 4, 5]. Rather, we focused on those individuals with clinically relevant, self-reported congestion as well as reports of potential nonallergic rhinitis triggers, occurring on an occasional to frequent basis. Thus, in all probability, our study is most likely evaluating a broad range of rhinitides (i.e., mixed rhinitis), but because our patients reported on three weather-induced symptoms, we labeled them as potential nonallergic rhinitis cases for the purposes of this report. Due to our focus on weather-related triggers, positive NAR cases may be particularly reflective of the condition known as vasomotor rhinitis.

Last, three validated questionnaires were completed: Insomnia Severity Index (ISI) [21], Epworth Sleepiness

Questions targeting timing of congestion, stuffiness, and rhinorrhea (CSR)[a]
My nose is congested, stuffy, or runny during the day
My nose is congested, stuffy, or runny at bedtime
I wake up at night with a congested, stuffy, or runny nose
I wake up in the morning with a congested, stuffy, or runny nose
Congestion, stuffiness, or a runny nose disrupts my sleep
Questions targeting specific triggers of nonallergic rhinitis (NAR)[b]
Changes in temperature stuff up or make my nose run
Changes in weather stuff up or make my nose run
Wind blowing in my face stuffs up or makes my nose run

Fig. 1 MSAS intake questions to assess CSR and potential NAR status. All questions based on a 5-point Likert scale with higher scores indicative of increased frequency (0 = never, 1 = rarely, 2 = occasionally, 3 = frequently, 4 = always); minimal cutoff scores reflect symptom frequency of occasional or greater. [a]Total possible CSR score = 20, with a minimum total score ≥6 qualifying patient as CSR+. [b]Total possible NAR score = 12, with a minimum total score ≥4 qualifying patient as NAR+

Scale (ESS) [22], and depression and anxiety scales from the Hopkins Symptom Checklist (HSCL) [23].

Objective measures

Diagnostic sleep studies (polysomnography) were conducted and scored per American Academy of Sleep Medicine practice parameters [24]. The apnea-hypopnea index (AHI = apneas + hypopneas per hour of sleep) and the respiratory disturbance index (RDI = AHI + respiratory effort-related arousals—aka RERAs—per hour of sleep) were calculated from diagnostic PSGs [25]. Diagnostic studies from our sleep center were used exclusively in this research due to considerable variability on other sleep facilities' reports regarding the use of standard technology (thermistors emphasized over nasal cannula pressure transducer, leading to underestimation of hypopneas) and scoring methods (lack of RERA scoring and thus inaccurate or absent RDI calculations) [26].

Sample and data analysis

A total of 2770 patients sought care from 2008 to 2012. Exclusions comprised 112 patients under the age of 18 along with 777 patients with CSR scores <6, leaving 1881 patients who reported clinical meaningful levels of nasal symptoms. However, 178 of the 1881 CSR+ patients were users of positive airway pressure (PAP) (a device which may aggravate NAR) at intake and were excluded from our analysis, resulting in a final sample of 1703 patients.

These 1703 patients were predominantly married (72.7 %), middle aged [52.79 (14.06) years], mildly obese [31.40 (20.73)], females (55.2 %) with some college education or less (54.0 %). No significant differences were observed for socio-demographics based on NAR group status; thus, no further analyses were conducted.

ANOVA was used to compare means for continuous variables and Hedge's g for effects for unequal sample sizes. Effect sizes are based on the standardized mean difference and thus are usually interpreted as a clinical indicator of small (0.20), medium (0.50), or large (0.80 or greater) effects. The 95 % confidence interval (95 % CI) was calculated. Chi-square analyses were conducted on dichotomous variables. All continuous data are presented as mean (standard deviation). All dichotomous data are presented as total number (percent). Statistical significance was .05. Data were analyzed with SPSS Software, Version 11.0.

Results

Among the 1703 CSR+ patients, there were 1194 potential NAR+ [NAR score = 7.08 (1.93)] and 509 NAR− patients [NAR score = 2.32 (1.56)]; thus, NAR+ status was present in 44.9 % (1194 of 2658) of the original sample of adult patients seeking treatment at the sleep center and 70.1 % (1194 of 1703) of those patients with clinically relevant congestion. Comparisons by NAR status showed significantly worse sleepiness (g = 0.35; 95 % CI, 0.25–0.46), insomnia severity (g = 0.16; 95 % CI, 0.05–0.26), anxiety (g = 0.20; 95 % CI, 0.09–0.30), and depression (g = 0.15; 95 % CI, 0.05–0.26) in NAR+ vs NAR− patients, but effects were small.

From the 1703 CSR+ cases, we next examined 1413 CSR+ patients who presented with one of the three chief complaint sub-groups for treatment at the sleep center [SDB (n = 368), NRS (n = 791), INS (n = 254)]. With analysis by category of the three chief complaints, there were no differences in the proportions of potential NAR+ vs NAR− cases (range 69.6 to 71.2 %), and there were also no significant differences in the severity of CSR or NAR scores.

When the SDB, NRS, and INS groups of presenting complaints were analyzed as one sample (n = 1413), NAR+ patients (n = 997) had significantly worse sleepiness (g = 0.36; 95 % CI, 0.25–0.48), insomnia severity (g = 0.18; 95 % CI, 0.07–0.30), and anxiety (g = 0.13; 95 % CI, 0.01–0.24) compared to NAR− patients (n = 416). However, within each of the individually analyzed presenting complaints, the results were not consistent; only the SDB-presenting complaint group showed statistical significance for all four symptom measures comparing NAR+ and NAR− status (Table 1). And, effect sizes were largest for the SDB group, showing significantly worse sleepiness (g = 0.39; 95 % CI, 0.17–0.61), insomnia severity (g = 0.25; 95 % CI, 0.03–0.47), anxiety (g = 0.30; 95 % CI, 0.08–0.52), and depression (g = 0.25; 95 % CI, 0.03–0.48) in NAR+ compared to NAR− (Table 1). Further comparisons by NAR status for NRS and INS groups were not consistent, and effect sizes were generally smaller.

Table 1 Congestion and symptom scores for patients with and without potential NAR, presenting with chief complaint of (1) sleep breathing, (2) nonrestorative sleep, or (3) insomnia problems

	Total sample (n = 1413)	NAR− (n = 416)	NAR+ (n = 997)	p value; Hedge's g[a]
Congestion score				
CSR score, total[b]	11.63 (3.63)	10.57 (3.39)	12.08 (3.64)	.001; 0.42
NAR score, total[c]	5.68 (2.84)	2.35 (1.54)	7.07 (1.96)	
Chief complaint				
(1) Sleep breathing problem	(n = 368)	(n = 112)	(n = 256)	
Congestion score				
CSR score, total	12.34 (3.81)	11.30 (3.60)	12.79 (3.81)	.001; 0.40
NAR score, total	5.60 (2.82)	2.36 (1.54)	7.03 (1.93)	
Symptom scores				
ESS score, total[d]	13.64 (5.66)	12.12 (5.58)	14.30 (5.57)	.001; 0.39
ISI score, total[e]	12.85 (5.64)	11.88 (5.75)	13.28 (5.55)	.03; 0.25
HSC anxiety[f]	0.30 (0.37)	0.22 (0.27)	0.33 (0.40)	.005; 0.30
HSC depression[f]	0.47 (0.51)	0.38 (0.44)	0.51 (0.54)	.03; 0.25
(2) Nonrestorative sleep problem	(n = 791)	(n = 228)	(n = 563)	
Congestion score				
CSR score, total	11.49 (3.56)	10.48 (3.39)	11.90 (3.54)	.001; 0.41
NAR score, total	5.66 (2.78)	2.36 (1.52)	7.00 (1.93)	
Symptom scores				
ESS score, total	13.97 (5.52)	12.61 (5.47)	14.52 (5.44)	.001; 0.35
ISI score, total	15.32 (4.78)	14.85 (4.75)	15.51 (4.78)	.08; 0.14
HSC anxiety	0.41 (0.44)	0.39 (0.44)	0.42 (0.43)	.33; 0.07
HSC depression	0.61 (0.58)	0.61 (0.57)	0.61 (0.58)	.94; 0.00
(3) Insomnia problem	(n = 254)	(n = 76)	(n = 178)	
Congestion score				
CSR score, total	11.04 (3.45)	9.75 (2.84)	11.60 (3.54)	.001; 0.55
NAR score, total	5.85 (3.02)	2.34 (1.63)	7.35 (2.09)	
Symptom scores				
ESS score, total	12.29 (5.87)	10.87 (5.52)	12.89 (5.93)	.01; 0.35
ISI score, total	19.43 (5.21)	18.46 (5.43)	19.84 (5.07)	.05; 0.27
HSC anxiety	0.55 (0.62)	0.49 (0.64)	0.57 (0.60)	.38; 0.13
HSC depression	0.73 (0.71)	0.65 (0.72)	0.76 (0.70)	.25; 0.16

Continuous variables expressed as mean(SD)

[a] p value determined using ANOVA; Hedge's g used to determine effect size for unequal sample sizes

[b] Total possible congestion, stuffiness, and rhinorrhea (CSR) score = 20, with a total score ≥6 qualifying patient as CSR+

[c] Total possible nonallergic rhinitis (NAR) score = 12, with a total score ≥4 qualifying patient as NAR+

[d] Epworth Sleepiness Scale (ESS)—validated questionnaire consisting of eight questions scored on a 4-point (0 to 3) Likert scale based on increasing severity. Total score ranges from 0 to 24 with a total score <10 indicative of mild sleepiness, 10–18 moderate sleepiness, and ≥19 severe sleepiness

[e] Insomnia Severity Index (ISI)—validated questionnaire consisting of seven questions scored on a 5-point (0 to 4) Likert scale based on increasing severity of the symptom, with total scores ranging from 0 to 28 with scores ≥15 equivalent to clinically significant insomnia

[f] Hopkins Symptom Checklist (HSC)—validated questionnaire consisting of 25 questions scored on a 4-point (0 to 3) Likert scale, using an inter-item average based on increasing severity: 10 questions assess anxiety symptom severity and 15 assess depressive symptom severity(UARS)]

Our final analysis focused only on 1185 patients diagnosed with sleep breathing disorders at our sleep center [OSA, n = 1043, AHI = 28.78 (25.41), RDI = 51.89 (24.90) and UARS, n = 142, AHI = 2.11 (1.41), RDI = 32.86 (15.79)]. These 1185 diagnosed cases comprised NAR+ (n = 827) and NAR− (n = 358) cases, and the former showed significantly

worse symptoms than the latter (all $p < .05$), but effects were small [sleepiness ($g = 0.29$; 95 % CI, 0.17–0.42), insomnia severity ($g = 0.15$; 95 % CI, 0.03–0.28), anxiety ($g = 0.20$; 95 % CI, 0.07–0.32), and depression ($g = 0.17$; 95 % CI, 0.05–0.30)].

Discussion

Among treatment-seeking sleep center patients, regardless of presenting complaint, potential nonallergic rhinitis symptoms were highly prevalent, albeit from our study we could not determine how this rate compares to prevalence in the general population [3,7]. Potential NAR+ status was associated with the most consistent and largest effects on sleepiness, insomnia, anxiety, and depressive symptoms in patients who presented with a chief complaint of sleep breathing problems, albeit some of the effects were small. Patients with diagnosed OSA/UARS also showed significantly worse symptoms in NAR+ cases. These effects raise questions on how NAR or other rhinitis symptoms might affect any sleep disorder, including sleep apnea despite the lack of a correlation between potential NAR and sleep breathing event indexes. Nonetheless, potential NAR might interfere with sleep apnea patients' efforts to use positive airway pressure therapy in the long term, especially if chronic congestion is aggravated by "wind" blowing in the nose [14].

Overall, the consistency of our findings, despite the small magnitude of effects in some variables, would support the need for greater attention to nasal breathing patency in patients at sleep medical centers and other clinical venues. That NAR was associated significantly with both sleep and mental health symptoms only in the group presenting with an SDB complaint suggests at least one area of possible intersection between sleep medicine and mental health. In addition, it may prove illuminating to conduct prevalence studies in outpatient clinics among mental health patients with anxiety or depressive disorders and co-morbid nonallergic rhinitis while simultaneously screening for sleep disorders. Speculatively, research may uncover organic changes in nasal breathing linked in some way to the increased levels of distress found in patients who suffer from chronic anxiety or depression as these two symptoms have previously been associated with nonallergic rhinitis [27, 28].

In the clinical sleep center venue, there is also an opportunity to address NAR symptoms as a first-line and conservative treatment target when patients exhibit reluctance toward more obtrusive therapy such as positive airway pressure therapy for OSA/UARS. For example, when an insomnia patient presents with a chief complaint of unwanted sleepless periods at night, the sleep doctor may find the patient reluctant to spend a night in the sleep lab, despite the mounting evidence that insomnia and sleep breathing problems frequently co-occur [29]. In these cases, sleep specialists may initiate therapy with standard insomnia treatments [30] and simultaneously attempt to convince the patient in the short term to consider the advantages of healthier nasal breathing. Among receptive patients suffering allergic or nonallergic rhinitis or both, nasal steroid or antihistamine sprays may be recommended; patients can then monitor whether or not such conservative therapy improves sleep [11, 14, 15, 18]. This same pattern of care could be provided in a variety of clinical venues such as ENT clinics, mental health facilities, and primary care centers when appropriate patients express aversion to testing in a sleep lab.

Finally, as noted above, PAP therapy may exacerbate chronic congestion, sometimes immediately, leading to decreased nasal patency [31, 32] and, anecdotally, it may increase risk of rhinosinusitis [33]. The "wind" of pressurized airflow appears to act as a trigger that causes increased rhinitis symptoms, which hinders adaptation to PAP therapy [34] and may result in early cessation or rejection of therapy [35]. Research in this specific area may prove especially fruitful in light of our findings showing the largest associations between NAR+ symptoms and patients presenting with a chief complaint of sleep breathing problems.

In sum, research is needed to further examine the prevalence of NAR among sleep disorder patients to enhance awareness of this common condition among sleep medicine professionals. Research is also needed on NAR effects on sleep, including studies on therapeutic interventions that ameliorate or prevent nasal congestion. Prospective, randomized controlled trials are warranted to compare and contrast the effects of nasal antihistamine sprays and steroid sprays or combinations thereof on any type of sleep disorder patient suffering from chronic nasal congestion due to the various rhinitides. These studies must also include thorough objective examinations of the nasal airway, because upper airway surgery may prove an additional area worthy of study in the treatment of NAR [6].

Limitations

The main limitation is the lack of validated methods to determine whether the potential NAR group met diagnostic criteria for nonallergic rhinitis or were also suffering co-morbid allergic rhinitis as well as other forms of rhinitis such as those related to animal allergy. No allergy testing, blood testing, skin testing, nasal smears, or validated scales were used in our methods, and patients did not undergo formal evaluations from allergists or otolaryngologists. The lack of objective information on the anatomy of inferior turbinates, internal nasal valves, and nasal septum further limited our capacity to delineate the pathophysiology of our patients' nasal congestion complaints. By not using a validated scale, we could not accurately assess a severity level of the potential NAR symptoms, and as our survey aimed more at symptoms of vasomotor rhinitis, other types of NAR may have been

underestimated. Moreover, nasal congestion symptoms in our arid climate are likely to be different than those in other climates, and future studies should compare differences in prevalence between various climates. Also, we were unable to assemble a comparison group of general population subjects in our area with NAR symptoms; therefore, the study was uncontrolled regarding our prevalence findings. Pre- and post-treatment outcomes and adverse effects following the use of specific nasal sprays were not available from our sample, which could have proven useful in confirming and validating the presence of NAR symptoms, albeit some cases of inadequately treated allergic rhinitis may respond well to antihistamine nasal sprays, which could serve as a further confound to future research. And to reiterate, other forms of rhinitis were likely embedded within the group we labeled NAR+, and treatment outcomes would have improved our capacity to clarify the types of rhinitides in our sample.

Conclusions

In this large sample of sleep center patients presenting for complaints of insomnia, nonrestorative sleep, and sleep-disordered breathing as well as among a cohort of diagnosed OSA/UARS patients, potential nonallergic rhinitis symptoms were very common. The rates may be more common than in the general population, and NAR+ status was associated with worse symptoms. To our knowledge, nonallergic rhinitis has not been previously studied in a sleep center sample, yet our findings suggest a potential for NAR to be an important symptom to monitor given that nasal congestion interferes with sleep, and treatment of nasal congestion may improve sleep outcomes. Research studies directed at both assessment and treatment of nonallergic rhinitis in sleep disorder patients are warranted.

Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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Conflict of interest Ms. Foley-Shea, Ms. McIver, Mr. Ulibarri, and Dr. Honsinger certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements) or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript. Dr. Krakow has multiple disclosures that are related to his work in sleep medicine. They are as follows:

For websites:

- www.nightmaretreatment.com
- www.ptsdsleepclinic.com
- www.sleeptreatment.com
- www.sleepdynamictherapy.com
- www.soundsleepsoundmind.com
- www.nocturiacures.com

For other professional services: Medical director of a national DME company Classic Sleep Care for which sole functions are consultation and QA; neither patient encounters nor benefit from the sale of any DME equipement.

For intellectual property: Markets and sells 3 books for sleep disorders patients

- *Insomnia Cures*
- *Turning Nightmares into Dreams*
- *Sound Sleep, Sound Mind*

For clinical services: Owns and operates one commercial sleep center

- Maimonides Sleep Arts & Sciences, Ltd

For educational and consulting services: Conducts CME/CEU educational programs for medical and mental health providers to learn about sleep disorders.

President of a non-profit sleep research center, the Sleep Human Health Institute (www.shhi.org) that occasionally provides consultation services or receives grants for pilot studies, the most recent of which were:

- ResMed ~$400,000 January 2015 (funding for randomized control trial of treatment in insomnia patients)

Retrospective study For this type of study, formal consent is not required.

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Comment

This is a retrospective, single center study of the prevalence of potential nonallergic rhinitis (NAR) in patients presenting to a sleep center. Patients answered questionnaires to identify nasal symptoms and to categorize them as potential NAR or other nasal symptoms (likely predominantly allergic). The use of a non-validated questionnaire is a clear drawback, and the entity identified as NAR likely represents mixed etiologies of symptoms in these patients. Similarly, allergy testing was not performed to formally exclude allergic rhinitis. Nevertheless, the study brings to attention to the sleep community the problem of NAR, which appears to be common based on the authors' data, occurring in 45% of patients presenting to their sleep center. NAR, compared with other forms of nasal symptoms, was associated with greater sleepiness, insomnia, anxiety and depression scores, particularly in the group with a complaint of sleep-disordered breathing, as well as those with confirmed sleep-disordered breathing, though effect sizes were for the most part modest. Why those with NAR should have greater symptoms than those with other forms of rhinitis or congestion is not clear. One possibility is the failure to recognize and treat the problem. Another is that the questionnaire identified individuals with greater severity of nasal symptoms. NAR may be especially important in the context of OSA because it might contribute to OSA pathogenesis, and be an important factor in the success of CPAP treatment. This study opens the way for further research on NAR in the context of sleep disorders.

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