Brief Communication

Diagnostic and Statistical Manual criteria for insomnia related impairment in daytime functioning: Polysomnographic correlates in older adults

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ABSTRACT

Objective: Diagnosis of insomnia disorder by the Diagnostic and Statistical Manual (DSM)-IV, and as proposed by the DSM-V, includes criteria for impairment in occupational- or social functioning due to sleep complaints. This study evaluated the clinical and polysomnographic correlates of impairment in daytime functioning in older adults with insomnia.
Methods: In older adults with DSM-IV chronic insomnia ($n = 68$), clinical and demographic information, and measures of health functioning, medical co-morbidity, and polysomnographic sleep were obtained. Four questions that evaluated difficulties or distress in occupational- or social functioning related to sleep complaints were used to code DSM threshold criteria for impairment in daytime functioning. Stepwise regression was used to identify predictors of impairment in daytime functioning.
Results: Impairment in daytime functioning was significantly associated with younger age ($p < 0.05$), and the amount of wake time after sleep onset as assessed by polysomnography ($p < 0.001$), controlling for health functioning and minority racial status.
Conclusions: Amount of wake time after sleep onset uniquely contributes to criteria symptoms of impairment in daytime functioning among older adults with insomnia. Treatments that target sleep maintenance have the potential to improve social and occupational functioning in older adults with sleep complaints.

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1. Introduction

Sleep disturbance constitutes one of the most common difficulties facing older adults, with nearly 60% of community-dwelling elderly reporting sleep problems at least a few nights per week and over 15% of older adults fulfilling diagnostic criteria for insomnia [1]. In addition to complaints about sleep quantity or quality, and reported difficulties with sleep onset or sleep maintenance, the diagnosis of insomnia requires evidence of significant distress or impairment in daytime functioning, namely symptoms of fatigue, sleepiness, attentional- or memory complaints, or mood disturbance, which impair occupational, social, or interpersonal functioning [2,3]. Whereas the clinical correlates of sleep complaints have been studied broadly across the life span including older adults [4,5], less is known about the factors that contribute to impairment in daytime functioning as indexed by DSM criteria, which is a consequence of sleep complaints [3]. Moreover, no study to our knowledge has examined the relationship between poly-

somnographic sleep and DSM criteria of impairment in occupational or social functioning in older adults with chronic insomnia. In older adults, Gooneratne et al. reported that the combination of insomnia symptoms and sleep related breathing disorder, as indexed by polysomnography, was associated with daytime fatigue and sleepiness, although criteria symptoms of impaired functioning were not assessed [6]. This study examined the clinical and polysomnographic correlates of DSM criteria symptoms of functional impairment in older adults with insomnia.

2. Methods

2.1. Subjects

In 2006 a randomized controlled trial (NCT00280020) was begun to evaluate the efficacy of behavioral treatments for DSM-IV insomnia in older adults. The present study is based on cross-sectional, baseline analyses of the first 68 participants who were enrolled in this trial. Male and female subjects older than 55 years were recruited via local print advertisements as approved by the Institutional Review Board. After telephone screening, participants were invited for interview, gave informed consent, and underwent

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a Structured Clinical Interview for DSM-IV (SCID) [7]. Diagnosis of insomnia was made in weekly consensus meetings in which criterion validity and reliability were monitored by the study psychiatrist (MRI). Regular viewing and scoring of videotaped interviews, along with the consensus meeting, maintained high inter-rater reliability ($r = 0.94$). All eligible participants fulfilled criteria for the presence of primary insomnia as defined by the DSM-IV-TR [8], with exclusion of those that had another current Axis I psychiatric disorder or medical comorbidities that were judged to impact sleep (e.g., unstable cardiovascular disease). We excluded subjects who were diagnosed with current major depressive disorder and those who used sedative hypnotic medications in the week prior to assessment of polysomnographic sleep.

2.2. Procedures

Demographic and clinical information was obtained by interview and questionnaire. To assess health functioning, the Short Form-36 (SF-36) was administered with use of its summary score for Physical Functioning (PCS) [9]. To evaluate the presence of medical co-morbidity, a physician (LK) obtained a medical history and completed a review of medical systems and physical examination; this information was used in the scoring of the Cumulative Illness Rating Scale-Geriatric Score (CIRS-G) [10]. Alcohol and tobacco use histories were obtained by interview.

DSM criteria symptoms of impairment in daytime functioning were coded using four "yes/no" format questions that asked whether sleep difficulties "interfered with working; decreased participation in recreational activities like sports; interfered with taking care of household responsibilities; or caused problems with friends or family." These four questions parallel the criteria symptoms of impaired daytime functioning delineated in DSM-IV-TR and also capture the criteria symptoms of impaired occupation, academic, social, and interpersonal functioning as proposed by DSM-V. These responses were summarized by a 0–4 scale measure indicating the number of "yes" answers.

After completion of baseline evaluation, subjects were asked to refrain from alcohol- or sedative hypnotic use for one week prior to entry into the polysomnography sleep protocol that included a night of adaptation to the sleep laboratory followed by two nights in the UCLA General Clinical Research Center as previously described [11,12]. No subject was allowed to use a hypnotic medication during the sleep protocol. During the night of adaptation, the presence of periodic limb movement or sleep apnea was evaluated, with exclusion of subjects who showed >15 limb movements per hour with arousal or >15 hypopneic or apneic episodes (>4% desaturation) per hour with arousal, respectively. Data were averaged across the two nights of sleep after completion of the night of adaptation. All sleep records were visually scored in accordance with Rechtschaffen and Kales criteria [13].

2.3. Statistical analyses

Data obtained were converted in SPSS (version 16.0; SPSS Inc, Chicago, IL) for analysis. As this was an analysis of the correlates of impairment in daytime functioning, the goal was to maximize the number of potential correlates given a modest sample size. Three domains of variables (demographic- and clinical; health functioning and medical co-morbidity; and polysomnography) were categorized: the demographic and clinical (i.e., age, sex, ethnicity, minority racial status, marital status, employment status, body mass index); health functioning and medical co-morbidity (i.e., SF-36-PCS, CIRS-G); and polysomnography (i.e., total sleep time, sleep onset latency, wake time after sleep onset [WASO], and percentages of NREM stage 2, slow wave, and rapid eye movement sleep). (Note: some additional measures, e.g., sleep efficiency

and percentage of NREM stage 1 sleep, were excluded due to mathematical co-linearity with included variables).

Stepwise multiple regression analyses were then utilized to add variables to the prediction model in the following order: clinical and demographic variables, health functioning and medical co-morbidity, and polysomnographic measures. Only variables showing some trend ($p < 0.10$) were retained when the next set in the order was tested; these variables, however, were always retained even if, in subsequent models, they no longer achieved the set criterion ($p < 0.10$). The final model thus included all variables that had at one step met the specified threshold. The dependent variable in these analyses was a composite measure of impaired occupation, interpersonal function, or social function as defined by DSM criteria symptoms on a 0–4 scale.

3. Results

Subjects ($n = 68$) fulfilled criteria for chronic primary insomnia as determined by SCID-IV and had a mean age of 66.2 years (SD = 7.7); education level of 15.5 years (SD = 1.5); and body mass index (BMI) of 25.9 (SD = 3.7). Of the sample, 73.5% were female, 11.8% were of a non-white race, 8.8% were of Hispanic ethnicity, 33.8% were married or cohabitating, and 47.1% were employed.

In this older adult sample, measures of health status indicated that persons were generally in good medical health; subjects had PCS as determined by the SF-36 of 47.9 [SD = 8.4] and CIRS-G scores of 2.1 [SD = 2.1]. None of the subjects were smokers, and alcohol use was infrequent; only 53% reported drinking in the last 90 days, with an average of 0.3 [SD = 0.6] drinks per day. All subjects reported refraining from use of alcohol in the week prior to assessment of polysomnographic sleep.

Measures of polysomnographic sleep showed prominent disturbances of sleep continuity in this insomnia sample as shown in Table 1. The composite measure of DSM impairment in daytime function ranged from 0 to 4 with a mean of 1.87 [SD = 1.43]. The distribution of scores was not skewed (skew = 0.20, SE skew = 0.29), and was appropriate for use in multiple regression without the need for any transformations.

To determine the clinical and polysomnographic correlates associated with DSM impairment in daytime function, we used stepwise multivariate regression analyses with variables across three domains including demographic characteristics, self-reported health status, and polysomnographic sleep. In the first set, age ($t = 1.89$, $p = 0.06$) and minority status ($t = 2.16$, $p < 0.05$) entered the model. Of the second set, only PCS was significant ($t = 2.00$, $p = 0.05$), when age and minority status were included in the model. Finally in the third regression examining the polysomnographic measures (and including age, minority status, and PCS), only WASO was retained ($t = 1.66$, $p = 0.10$). The final regression model showed that severity of impairment in daytime function was associated with younger age ($\beta = -0.26$, $p < 0.05$), and only marginally to minority status and PCS (see Table 2). On the other hand, severity of impairment in daytime function was highly

Table 1
Polysomnographic sleep measures in older adults with insomnia.

Variable	Mean	SD
Total sleep time (min)	350.0	56.7
Sleep onset latency (min)	28.2	23.2
Sleep efficiency (%)	72.9	11.9
WASO (min)	92.6	43.8
Stage 1 (%)	11.3	17.0
Stage 2 (%)	64.0	11.6
Stage 3–4 (%)	1.1	3.4
REM sleep (%)	23.6	6.3

Table 2
Predictors of DSM criteria symptoms of impairment in daytime function.

Variable	B	β	t-value	p-value
Constant	5.503			
Age[1]	−0.05	−0.26	2.44	0.02
Minority status[1]	−0.70	−0.16	1.48	0.15
PCS[2]	−0.03	−0.20	1.83	0.07
WASO[3]	0.01	0.40	3.78	<0.001

Superscript represents which set the variable entered in the final model.
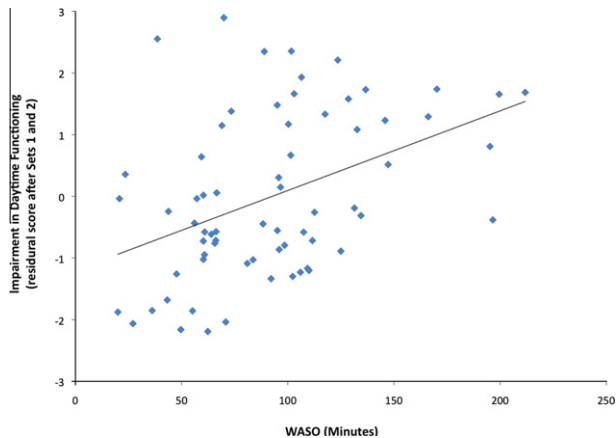

Fig. 1. Association between amount of wake after sleep onset in minutes, as indexed by polysomnography, impairment in daytime function in older adults with insomnia in the final model. ($\beta = 0.40$, $p < 0.001$).

related to one measure of polysomnographic sleep, amount of awake time after sleep onset ($\beta = 0.40$, $p < 0.001$) (Fig. 1).

4. Discussion

Among older adults with insomnia, criteria symptoms of daytime impairment in functioning were most consistently associated with younger age and amount of wake time after sleep onset in this older adult sample. Relative youth may indicate potential for insomnia's greater impact on a comparatively higher level of functionality. It is also possible that the older subjects in the sample had greater chronicity to their insomnia and had perhaps learned to function with the adverse daytime consequences experienced. Alternatively, it is possible that younger people were more likely to be working and needed to perform at a higher level, although employment status was not related to daytime functioning.

Nocturnal awakenings disrupt the sleep of about one-third of the general population [2]. In this study, increased wake time after sleep onset was found to be a significant correlate of impairment in daytime functioning. Whereas recent work has found that self-reported difficulty resuming sleep was associated with subjective shorter sleep duration, poorer sleep quality, greater daytime impairment, greater consultations for sleep disturbances and greater likelihood of receiving a sleep medication [2], we believe this was the first study to incorporate polysomnographic-derived wake time after sleep onset data as a correlate of impaired occupational or social functioning in older adults with insomnia. Together, these findings suggest that interventions targeting objective wake time after sleep onset could potentially reduce some of the daytime consequences of sleep complaints. Such approaches might include the use benzodiazepine receptor agonists [14], or behavioral approaches such as stimulus control instructions that improve

sleep maintenance beyond the initial short-term treatment time [15].

There were several limitations to this study, including the relative outnumbering of males by females in the sample. Second, impairment in daytime functioning relied on reported difficulties in occupational and social function without objective assessment of dysfunction, although this method is consistent with DSM diagnostic criteria. Third, subjects in this sample were relatively healthy and may not have been representative of the older adult population. Nevertheless, these findings demonstrate that amount of wake time after sleep onset as indexed by polysomnography uniquely contributes to criteria symptoms of impairment in daytime function in older adults with insomnia.

Conflict of Interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: doi:10.1016/j.sleep.2012.03.015.

Acknowledgments

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