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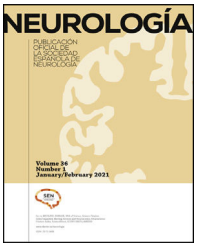

ORIGINAL ARTICLE

Insomnia and poor sleep quality are associated with poor seizure control in patients with epilepsy☆

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KEYWORDS
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Abstract
Objective: This study aimed to assess the presence of sleep disorders in patients with epilepsy and to analyse their association with seizure control.
Methods: We performed a cross-sectional study of patients with epilepsy, recruited consecutively between September 2017 and December 2018. Patients were classified as having good seizure control (no seizures in the last 4 weeks) or poor seizure control (at least one seizure in the last 4 weeks). We performed intergroup comparisons for demographic and clinical data, insomnia (Insomnia Severity Index [ISI]), excessive daytime sleepiness (Epworth Sleepiness Scale [ESS]), sleep quality (Pittsburgh Sleep Quality Index [PSQI]), depression (Beck Depression Inventory-II [BDI-II]), and quality of life (Quality of Life in Epilepsy Inventory-10 [QOLIE-10]).
Results: The sample included a total of 123 patients, of whom 31.7% had excessive daytime sleepiness (ESS $\geq$ 10), 50.4% had insomnia (ISI $\geq$ 10), and 53.6% had poor sleep quality (PSQI $\geq$ 5). According to our multivariate analysis, presence of seizures was associated with unemployment (odds ratio [OR] = 4.7; 95% confidence interval [CI], 1.36-19.2; P = .02), a higher number of antiepileptic drugs (OR = 5.87; 95% CI, 1.81-27.1; P < .001), insomnia (OR = 1.9; 95% CI, 1.1-9.3; P = .04), and poor sleep quality (OR = 2.8; 95% CI, 1.9-10.32; P = .01).
Conclusions: Sleep disorders are common in patients with epilepsy. Insomnia and poor sleep quality were associated with poor seizure control. These findings support the hypothesis that sleep disorders constitute a significant comorbidity of epilepsy, especially in patients with poor seizure control.

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PALABRAS CLAVE
Insomnio;
Calidad de sueño;
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Control de crisis

El insomnio y la pobre calidad de sueño se asocian a un mal control de crisis en pacientes con epilepsia

Resumen
Objetivos: Evaluamos la presencia de trastornos del sueño en pacientes con epilepsia y analizamos su asociación con el control de las crisis.
Métodos: Se realizó un estudio transversal de pacientes con epilepsia reclutados consecutivamente entre septiembre de 2017 y diciembre de 2018. Los pacientes se clasificaron en dos grupos según el control de crisis (buen control: pacientes sin crisis en las últimas 4 semanas) o mal control (pacientes con una crisis o más en las últimas 4 semanas). Se compararon variables demográficas y clínicas; insomnio, medido por el Índice de Severidad del Insomnio (ISI); somnolencia diurna excesiva, medida por la Escala de Somnolencia de Epworth (ESE); calidad del sueño, medida por el Índice de calidad del Sueño de Pittsburgh (PSQI); depresión, medida por el Inventario de Depresión de Beck-II (BDI-II); y calidad de vida, medida por el test de Calidad de Vida en Epilepsia (QOLIE-10).
Resultados: Se incluyeron 123 pacientes. El 31,7% tenía somnolencia diurna excesiva (ESS $\geq$ 10), el 50,4% insomnio (ISI $\geq$ 10) y el 53,6% mala calidad del sueño (PSQI $\geq$ 5). Los factores asociados con la presencia de crisis fueron el desempleo (*odds ratio* [OR] = 4,7; intervalo de confianza del 95% [IC 95%]: 1,36—19,2; p = 0,02), un mayor número de fármacos antiepilépticos (OR = 5,87; IC 95%: 1,81—27,1; p < 0,001), insomnio (OR = 1,9; IC 95%: 1,1—9,3; p = 0,04) y mala calidad del sueño (OR = 2,8; IC 95%: 1,9—10,32; p = 0,01).
Conclusiones: Los trastornos del sueño son frecuentes en pacientes con epilepsia. El insomnio y la mala calidad del sueño se asociaron con un peor control de crisis. Estos hallazgos apoyan que los trastornos del sueño son una comorbilidad frecuente en epilepsia, especialmente en pacientes con peor control de crisis.

Introduction

Epidemiological studies into insomnia and sleep quality estimate that approximately 30% of adults present symptoms of insomnia, 10% chronic insomnia,[1,2] and approximately 40% poor sleep quality.[3–5] Patients with epilepsy present sleep problems such as insomnia, excessive daytime somnolence, and poor sleep quality, more frequently than healthy controls.[6–10] Furthermore, sleep alterations in patients with epilepsy have been associated with a poorer quality of life.[6–8,11,12] Sleep deprivation may induce electroencephalographic activity and is frequently used in epilepsy monitoring units to trigger seizures.

Hypotheses on the association between sleep alterations and seizure control are supported by studies that have shown improvements in seizure frequency after treatment for obstructive sleep apnoea.[13,14] However, the impact of sleep alterations on seizure control remains unknown as current evidence is inconsistent and contradictory.[6–10]

This study addresses the hypothesis that insomnia, excessive daytime sleepiness, and poor sleep quality are prevalent in patients with epilepsy and are associated with seizure control. To test this hypothesis, we determined the presence of these sleep alterations in patients with epilepsy and analysed their association with seizure control after classifying patients into 2 groups according to whether they presented seizures.

Methods

Patients

We performed a cross-sectional study of consecutive patients diagnosed with epilepsy by a specialist neurologist, recruited between September 2017 and December 2018 at the epilepsy unit at Hospital Germans Trias i Pujol (a tertiary-level hospital in Barcelona).

We excluded patients with previous diagnosis of psychogenic seizures or with intellectual disability hindering completion of the survey. The protocol was approved by our centre's ethics committee, and all patients gave written informed consent.

Clinical assessment

During routine follow-up visits, a neurologist specialising in epilepsy interviewed the patients and gathered information on seizure frequency, seizure type,[15] the presence of nocturnal seizures, disease duration (defined as the time since onset of the patient's typical seizures), and the number and type of antiepileptic drugs. The monthly frequency of seizures was calculated as the mean number of seizures during the 4 weeks prior to study inclusion. Data were collected

for 4 weeks, which coincided with the time period in which interviews were conducted.

Patients were classified into 2 groups: patients without seizures during that time interval (good seizure control group) and patients with one or more seizures in the last 4 weeks (poor seizure control group). Seizure type was classified as simple focal seizures, complex focal seizures, or generalised seizures (primary generalised seizures or focal seizures with secondary generalisation).[5]

The following demographic and clinical variables were retrospectively collected: *1)* demographic variables (age, sex, body mass index [BMI], marital status, employment status, tobacco use), *2)* concomitant treatment (hypnotics, antidepressants, other psychotropic drugs), *3)* comorbidities (obstructive sleep apnoea, asthma, and hypertension), and *4)* history of epilepsy surgery.

Questionnaires

During visits, patients were asked to complete the following validated self-administered questionnaires: the Insomnia Severity Index (ISI), the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQI), the Beck Depression Inventory (BDI-II), and the Quality of Life in Epilepsy Inventory-10 (QOLIE-10). The ISI measures the presence of insomnia and the degree of discomfort caused by this symptom. It is a 7-point Likert-type scale with a total score between 0 and 28. Scores $\geq$ 10 are indicative of significant clinical insomnia.[16] The ESS measures subjective perception of predisposition to somnolence throughout the day, in different situations.[17] Scores $\geq$ 10 are indicative of excessive daytime sleepiness. The PSQI measures the subjective quality of sleep and sleep alterations in the previous month. The scale includes 19 items measuring 7 components of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Scores $\leq$ 5 indicate absence of sleep problems and scores > 5 indicate presence of sleep problems.[18] The BDI-II assesses the severity of depressive symptoms over the previous 2 weeks.[19] Scores between 17 and 20 indicate mild depression; 21-30 moderate depression; and > 31 severe depression. Finally, the QOLIE-10 determines the quality of life of patients with epilepsy.[20] We standardised results between 0 and 100, with higher values indicating better quality of life than lower values. We used the validated Spanish-language versions of all scales.[21—25]

Statistical analysis

Variables were compared between patients with good and poor seizure control. We performed a descriptive analysis of the main variables (mean, standard deviation [SD], and frequency tables). We used the chi-square test to compare categorical variables, and the *t* test to compare continuous variables. We used logistic regression analysis with the Enter method to determine the independent effect of each variable on seizure control. Statistical analysis was completed using the SPSS software, version 18.0, and the threshold for statistical significance was established at $P < .05$.

Table 1 Clinical and demographic characteristics (n = 123).

Demographic data	
Age in years (mean ± SD)	44.6 ± 13.5
Sex (men)	73 (59.3%)
BMI (mean ± SD)	24.8 ± 4.37
Employed	52 (42.2%)
Comorbidities	
Hypertension	19 (15.4%)
Asthma	11 (8.9%)
Obstructive sleep apnoea	6 (4.8%)
Other drugs and substances	
Tobacco use	41 (33.3%)
Hypnotics	14 (11.4%)
Antidepressants	23 (18.6%)
Other psychotropic drugs	6 (4.8%)
Characteristics of epilepsy	
Seizure type	
Simple focal seizures	23 (18.6%)
Complex focal seizures	43 (34.9%)
Generalised tonic-clonic seizures (primary or secondarily generalised)	57 (46.3%)
Seizure frequency (mean ± SD)	2.5 ± 6.3
Disease duration in years (mean ± SD)	15.2 (13.6)
Number of antiepileptic drugs (mean ± SD)	2.1 ± 1.3
Vagus nerve stimulation	5 (4%)
Surgical resection	8 (6.5%)
Questionnaire on sleep	
ISI	
Significant clinical insomnia (ISI $\geq$ 10)	62 (50.4%)
ESS	
ESS $\geq$ 10	39 (31.7%)
PSQI	
Total PSQI (mean ± SD)	6.53 ± 4.8
No sleep problems (PSQI $\leq$ 5)	57 (46.3%)
Sleep problems (PSQI > 5)	66 (53.6%)
Questionnaires on mood alterations	
BDI-II	
1-10	68 (55.3%)
11-16	20 (16.2%)
17-20	24 (19.5%)
21-30	7 (5.6%)
31-40	4 (3.2%)
Quality of life	
QOLIE-10, standardised results (mean ± SD)	72.53 ± 23.29

BDI-II: Beck Depression Inventory-second edition; BMI: body mass index; ESS: Epworth Sleepiness Scale; ISI: Insomnia Severity Index; PSQI: Pittsburgh Sleep Quality Index; QOLIE-10: Quality of Life in Epilepsy Inventory-10; SD: standard deviation.

Results

Patients

Table 1 lists patients' clinical and demographic characteristics. Of a total of 123 patients analysed, 73 (59.3%) were men. Mean age (standard deviation) was 44.6 (13.5) years

(range, 17-80) and mean disease duration was 15.2 (13.6) years. Seizure type was simple partial in 23 patients (18.6%), partial complex in 43 (34.9%), and generalised (primary or focal with secondary generalisation) in 57 (46.3%). Mean monthly seizure frequency was 2.5 (6.3). Seventy-three patients (59.3%) had presented seizures in the previous 4 weeks and 50 (40.6%) had not. Patients were treated with a mean number of 2.1 (1.3) antiepileptic drugs. Thirty-five patients (28.4%) scored $\geq$ 17 in the BDI-II, indicating the presence of symptoms of depression; the standardised mean QOLIE-10 score was 72.53 (23.29).

In the analysis of sleep alterations, 62 patients (50.4%) presented clinical insomnia (ISI $\geq$ 10), 66 patients (53.6%) presented sleep problems (PSQI > 5), and 39 patients (31.7%) had excessive daytime sleepiness (ESS $\geq$ 10).

Factors associated with seizure control

Patients' demographic and clinical characteristics, as well as sleep alterations, are included in Table 2. The univariate analysis revealed that the poor seizure control group included a higher percentage of patients with secondarily generalised focal seizures (P = .001), longer disease duration (P = .01), greater number of antiepileptic drugs (P < .001), lower employment rates (P = .03), higher BDI-II scores (P < .001), and poorer quality of life (P < .001). We observed no differences between groups for age, sex, BMI, comorbidities, tobacco use, or use of concomitant medication (hypnotics, antidepressants, or other psychotropic drugs).

Sleep alterations were also more frequent in patients with poorer seizure control. This group included a higher percentage of patients with significant clinical insomnia (22% vs 6%; P = .02) and poor sleep quality (78.1% vs 42%; P = .002). When analysing the 7 items of the PSQI, patients with poorer seizure control presented poorer subjective sleep quality (P = .03), increased sleep latency (P = .01), shorter sleep duration (P = .001), and decreased sleep efficiency (P < .001). No statistically significant intergroup differences were observed in excessive daytime sleepiness.

The following factors were independently associated with poorer seizure control in the multivariate analysis (Table 3): generalised seizures (OR = 4.7; 95% CI, 1.36-19.2; P = .02), treatment with a greater number of antiepileptic drugs (OR = 5.87; 95% CI, 1.81-27.1; P < .001), clinical insomnia (OR = 1.9; 95% CI, 1.1-9.3; P = .04), and poorer sleep quality (OR = 2.8; 95% CI, 1.9-10.32; P = .01). Generalised seizures and poor sleep quality, but not nocturnal seizures, were associated with greater likelihood of insomnia (data not shown).

Discussion

This study assesses the association between sleep alterations and seizure control in patients with epilepsy at a tertiary-level hospital. Of the 123 patients analysed, 31.7% presented excessive daytime somnolence, 50.4% clinical insomnia, and 53.6% poor sleep quality. These data are consistent with previous studies showing that sleep alterations are frequent in patients with epilepsy, with prevalence rates of insomnia ranging from 15% to 55%[6–10] and poor sleep quality between 41% and 72%.[7,10] However, some population studies show a prevalence of insomnia of 9% in the general population,[26,27] with 30%-38% of the population reporting non-restorative sleep.[3,5,28]

Our findings indicate that sleep alterations are a frequent comorbidity in epilepsy. Presence of seizures was significantly associated with a higher unemployment rate, generalised seizures, longer duration of epilepsy, greater number of antiepileptic drugs, depressive symptoms, poorer quality of life, clinical insomnia, and poor sleep quality. Furthermore, patients with seizures presented poorer subjective sleep quality, increased sleep latency, shorter sleep duration, and decreased sleep efficiency. After adjusting for these variables, generalised seizures, number of drugs, insomnia, and poorer sleep quality continued to show an independent association with seizure frequency.

The results reported to date have been inconsistent, with some studies finding a statistically significant relationship between sleep alterations and poor seizure control[6,8,10] and other studies not reporting this association.[7,9] Table 4 shows the methodological differences between those studies. One of the studies that identified a significant association between insomnia and poor seizure control was a Greek study including 124 patients, which showed a positive correlation between presence of insomnia (measured with the Athens Insomnia Scale) and seizure frequency[6]; a subsequent survey including 207 participants with frequent seizures in the 4 previous weeks suggests that they presented greater prevalence of insomnia (measured with the ISI) than seizure-free patients.[8] Another case-control study conducted in Korea showed that seizure remission in the previous year was associated with lower prevalence of insomnia (also measured with the ISI).[10] Furthermore, 2 studies found no association between insomnia and seizure control: a retrospective study of 152 epileptic patients that excluded patients with known sleep alterations including obstructive sleep apnoea syndrome[7]; and a prospective study of 90 patients who underwent a polysomnography study, which revealed that the only variable of epilepsy that increased the probability of moderate or severe insomnia was polytherapy, considered a marker of drug-resistant epilepsy. That study excluded patients with previous polysomnography studies or known sleep alterations.[9] It should be noted that these studies present methodological differences. Firstly, the 2 studies finding no association between seizure control and insomnia excluded patients with obstructive sleep apnoea syndrome, which represents a selection bias. Secondly, while most previous studies use the ISI to assess insomnia, some studies consider it a continuous variable, whereas others treat it as a categorical variable. Thirdly, seizures were considered a categorical variable in some studies (seizure freedom vs presence of seizures) and a continuous variable in others (monthly number of seizures). The 2 studies that found no association between seizure control and insomnia analysed seizures as a continuous variable, whereas studies that did report such association considered it a categorical variable. Finally, differences were also observed in the duration of the period for which seizure frequency was determined (from 1 to 12 months).

The association between sleep alterations and the presence of seizures should be considered even though no

Table 2 Univariate analysis: demographic and clinical characteristics and sleep alterations in patients with and without seizures.

	No seizures, n = 50 (40.6%)	Seizures, n = 73 (59.3%)	*P*
Demographic variables			
Age in years (mean ± SD)	43.9 ± 14.23	42.33 ± 16.2	.5
Sex (men)	30 (60%)	41 (56.1%)	.5
BMI (mean ± SD)	25.62 ± 4.78	26.0 ± 4.05	.3
Active employment	26 (52%)	15 (20.5%)	**.03**
Comorbidities			
Hypertension	3 (6%)	11 (15%)	.9
Asthma	4 (8%)	6 (8.2%)	.8
Obstructive sleep apnoea	2 (4%)	4 (5.4%)	.1
Other drugs and substances			
Tobacco use	11 (27.5%)	29 (35%)	.1
Hypnotics	4 (10%)	10 (12%)	.5
Antidepressants	7 (17.5%)	11 (13.2%)	.8
Other psychotropic drugs	9 (2.2%)	6 (7.2%)	.06
Characteristics of epilepsy			
Generalised tonic-clonic seizures	17 (34%)	53 (72.6%)	**.001**
Nocturnal seizures	10 (20%)	20 (27.3%)	.7
Disease duration in years (mean ± SD)	14.9 ± 12.8	23.02 ± 16.86	**.01**
No. of antiepileptic drugs (mean ± SD)	1.81 ± 0.83	2.8 ± 0.92	**< .001**
Questionnaire on mood alterations			
BDI-II ≥ 17	9 (18%)	39 (53.4%)	**< .001**
Quality of life			
QOLIE-10, standardised results (mean ± SD)	75.72 ± 18.71	59.25 ± 22.06	**< .001**
ISI > 10	3 (6%)	16 (22%)	**.02**
ESS ≥ 10	20 (40%)	32 (43.8%)	.1
PSQI			
Total (mean ± SD)	536 ± 3.86	8.77 ± 4.35	**< .001**
PSQI ≤ 5	28 (56%)	16 (22%)	**.002**
PSQI > 5	21 (42%)	57 (78.1%)	
Subjective sleep quality (C1) (mean ± SD)	0.9 ± 0.8	1.5 ± 0.8	**.03**
Sleep latency (C2) (mean ± SD)	0.9 ± 0.9	1.5 ± 1	**.01**
Sleep duration (C3) (mean ± SD)	0.4 ± 0.6	1.27 ± 1	**< .001**
Sleep efficiency (C4) (mean ± SD)	0.5 ± 0.8	1.6 ± 1.1	**< .001**
Sleep disturbances (C5) (mean ± SD)	1.2 ± 0.6	1.2 ± 0.8	.6
Use of sleep medication (C6) (mean ± SD)	0.5 ± 1	0.8 ± 1	.09
Daytime dysfunction (C7) (mean ± SD)	0.8 ± 0.9	0.8 ± 1.1	.8

BDI: Beck Depression Inventory; BMI: body mass index; ESS: Epworth Sleepiness Scale; ISI: Insomnia Severity Index; PSQI: Pittsburgh Sleep Quality Index; QOLIE-10: Quality of Life in Epilepsy Inventory-10.
Statistically significant differences are shown in bold.

Table 3 Multivariate analysis: factors independently associated with poor seizure control.

	OR	95% CI	*P*
Generalised seizures	**4.7**	**1.36-19.2**	**.02**
No. of antiepileptic drugs	**5.87**	**1.81-27.1**	**< .001**
Insomnia (ISI ≥ 10)	**1.9**	**1.1-9.3**	**.04**
Poor sleep quality (PSQI > 5)	**2.8**	**1.9-10.3**	**.01**
Unemployment	1.3	0.9-2.8	.08
Longer disease duration	1.8	0.85-2.43	.32
Depression (BDI ≥ 17)	3.74	0.56-24.97	.16
Quality of life (QOLIE-10)	0.93	0.82-1.06	.26

95% CI: 95% confidence interval; BDI: Beck Depression Inventory; ISI: Insomnia Severity Index; OR: odds ratio; PSQI: Pittsburgh Sleep Quality Index; QOLIE-10: Quality of Life in Epilepsy Inventory-10.
Statistically significant differences are shown in bold.

Table 4 Studies assessing the relationship between insomnia and seizure frequency.

	n	Sleep scales used	Prevalence of sleep alterations	Seizure frequency	Period for which seizure frequency was calculated (months)	Relationship between insomnia and seizures
Piperidou et al.[6] (2008)	124	AIS	Insomnia (AIS ≥ 6): 24.6%	Categorical variable: [-]< 1 seizure/month; [-]1—5 seizures/month; [-]> 5 seizures/month	12	Yes
Vendrame et al.[7] (2013)	152	ISI PSQI	Insomnia: [-]ISI ≥ 8: 84% [-]ISI ≥ 15: 78% [-]PSQI > 5: 72%	Continuous variable: seizures/month	Not specified	No
Quigg et al.[8] (2015)	207	ISI	Insomnia [-]ISI ≥ 8: 51% [-]ISI ≥ 10: 43%	Categorical variable: [-]Seizure-free; [-]≥ 1 seizure/month	1	Yes
Yang et al.[9] (2016)	90	ISI	Insomnia [-]ISI ≥ 8: 36.7% [-]ISI ≥ 15: 28.9%	Continuous variable: seizures/month	6	No
Im et al.[10] (2016)	180	ISI PSQI	Insomnia [-]ISI ≥ 15: 15.6% Sleep problems: 41.1%	Categorical variable: [-]Seizure-free [-]Presence of seizures	12	Yes
Planas-Ballvé et al. (present study)	123	ISI PSQI	Insomnia: [-]ISI ≥ 8: 50.4% [-]ISI ≥ 15: 17.8% [-]PSQI > 5: 53.6%	Categorical variable: [-]Good seizure control (< 1 seizure/month) [-]Poor seizure control (≥ 1 seizure/month)	6	Yes

AIS: Athens Insomnia Scale; ISI: Insomnia Severity Index; PSQI: Pittsburgh Sleep Quality Index.

cause-effect relationship has been demonstrated. Sleep deprivation is a recognised trigger factor for seizures, especially in wake-up epilepsy. This relationship is not well understood, but evidence suggests that sleep deprivation increases neuronal excitability.[29] Furthermore, obstructive sleep apnoea is more frequent in adults with epilepsy than in the general population,[30,31] and there is growing evidence that treatment for this disorder may be associated with better seizure control.[13,14]

In the light of our results and those of previous studies, we believe that the administration of a structured interview focusing on sleep alterations, with such specific questionnaires as the ISI, may be useful in routine clinical practice. Identifying and treating patients with obstructive sleep apnoea may have implications for seizure control, as reported in previous studies.

Our study is not without limitations. The most significant limitations are its cross-sectional design and the small size of our sample, although previous studies analysing the relationship between sleep alterations and seizure control have used similar sample sizes.[6—10] Furthermore, we did not perform polysomnography studies to determine whether such other primary sleep disturbances as obstructive sleep apnoea may have contributed to insomnia and to the poor sleep quality detected.

In conclusion, our results contribute to the evidence supporting the association between sleep alterations and epilepsy, and suggest that insomnia and poor sleep quality are associated with poorer seizure control. We believe that the identification and control of sleep alterations may improve quality of life and seizure control in patients with epilepsy, although further prospective studies are needed to confirm these findings.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. Sleep Med Rev. 2002;6:97—111.
2. Ohayon MM, Sagales T. Prevalence of insomnia and sleep characteristics in the general population of Spain. Sleep Med. 2010;11:1010—8.
3. Hinz A, Glaesmer H, Brähler E, Löffler M, Engel C, Enzenbach C, et al. Sleep quality in the general population: psychometric properties of the Pittsburgh Sleep Quality Index, derived from a German community sample of 9284 people. Sleep Med. 2017;30:57—63.
4. Wong WS, Fielding R. Prevalence of insomnia among Chinese adults in Hong Kong: a population-based study. J Sleep Res. 2011;20:117—26.
5. Madrid-Valero JJ, Martínez-Selva JM, Ribeiro do Couto B, Sánchez-Romera JF, Ordoñana JR. Age and gender effects on the prevalence of poor sleep quality in the adult population. Gac Sanit. 2017;31:18—22.
6. Piperidou C, Karlovasitou A, Triantafyllou N, Terzoudi A, Constantinidis T, Vadikolias K, et al. Influence of sleep disturbance on quality of life of patients with epilepsy. Seizure. 2008;17:588—94.
7. Vendrame M, Yang B, Jackson S, Auerbach SH. Insomnia and epilepsy: a questionnaire-based study. J Clin Sleep Med. 2013;9:141—6.
8. Quigg M, Gharai S, Ruland J, Schroeder C, Hodges M, Ingersoll KS, et al. Insomnia in epilepsy is associated with continuing seizures and worse quality of life. Epilepsy Res. 2016;122:91—6.
9. Yang KI, Grigg-Damberger M, Andrews N, O'Rourke C, Bena J, Foldvary-Schaefer N, et al. Severity of self-reported insomnia in adults with epilepsy is related to comorbid medical disorders and depressive symptoms. Epilepsy Behav. 2016;60:27—32.
10. Im HJ, Park SH, Baek SH, Chu MK, Yang KI, Kim WJ, et al. Associations of impaired sleep quality, insomnia, and sleepiness with epilepsy: a questionnaire-based case-control study. Epilepsy Behav. 2016;57:55—9.
11. Alanis-Guevara I, Peña E, Corona T, López-Ayala T, López-Meza E, López-Gómez M, et al. Sleep disturbances, socioeconomic status, and seizures control as main predictors of quality of life in epilepsy. Epilepsy Behav. 2005;7:481—5.
12. De Weerd A, de Haas S, Otte A, Trenité DK, van Erp G, Cohen A, et al. Subjective sleep disturbance in patients with partial epilepsy: a questionnaire-based study on prevalence and impact on quality of life. Epilepsia. 2004;45:1397—404.
13. Vendrame M, Auerbach S, Loddenkemper T, Kothare S, Montouris G. Effect of continuous positive airway pressure treatment on seizure control in patients with obstructive sleep apnea and epilepsy. Epilepsia. 2011;52:e168—71.
14. Malow BA, Foldvary-Schaefe N, Vaughn BV, Selwa LM, Chervin RD, Weatherwax KJ, et al. Treating obstructive sleep apnea in adults with epilepsy: a randomized pilot trial. Neurology. 2008;71:572—7.
15. Berg AT, Berkovic SF, Brodie MJ, Buchhalter J, Cross JH, van Emde Boas W, et al. Revised terminology and concepts for organization of seizures and epilepsies: report of the ILAE Commission on Classification and Terminology 2005—2009. Epilepsia. 2010;51:676—85.
16. Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep. 2011;34:601—8.
17. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep. 1991;14:540—5.
18. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28:193—213.
19. Beck AT, Steer RA, Ball R, Ranieri W. Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. J Pers Assess. 1996;67:588—97.
20. Cramer JA, Perrine K, Devinsky O, Meador K. A brief questionnaire to screen for quality of life in epilepsy: the QOLIE-10. Epilepsia. 1996;37:577—82.
21. Fernandez-Mendoza J, Rodriguez-Muñoz A, Vela-Bueno A, Calhoun SL, Bixler EO, Vgontzas AN. The Spanish version of the Insomnia Severity Index: a confirmatory factor analysis. Sleep Med. 2012;13:207—10.
22. Chiner E, Arriero JM, Signes-Costa J, Marco J, Fuentes I. Validación de la versión española del test de somnolencia de Epworth en pacientes con síndrome de apnea del sueño. Arch Bronconeumol. 1999;35:422—7.
23. Macías Fernández JA, Royuela Rico A. La versión española del índice de la calidad de sueño de Pittsburgh. Inform Psiquiat. 1996;146:465—72.
24. Magán I, Sanz J, García-Vera MP. Psychometric properties of a Spanish version of the Beck Anxiety Inventory (BAI) in general population. Span J Psychol. 2008;11:626—40.
25. Viteri C, Codina M, Cobaleda S, Lahuerta J, Barriga J, Barrera S, et al. Grupo de investigadores del estudio de validación del cuestionario QOLIE-10. Validation of the Spanish version of the QOLIE-10 quality of life in epilepsy questionnaire. Neurologia. 2008;23:157—67.

26. Ancoli-Israel S, Roth T. Characteristics of insomnia in the United States: results of the 1991 National Sleep foundation survey. Sleep. 1999;22:347—53.
27. Morin CM, LeBlanc M, Daley M, Gregoire JP, Mérette C. Epidemiology of insomnia: prevalence, self-help treatments and consultations initiated, and determinants of help-seeking behaviors. Sleep Med. 2006;7:123—30.
28. Zeitlhofer J, Schmeiser-Rieder A, Tribl G, Rosenberger A, Bolitschek J, Kapfhammer G, et al. Sleep and quality of life in the Austrian population. Acta Neurol Scand. 2000;102:249—57.
29. Badawy RA, Curatolo JM, Newton M, Berkovic SF, Macdonell RA. Sleep deprivation increases cortical excitability in epilepsy: syndrome-specific effects. Neurology. 2006;67:1018—22.
30. Foldvary-Schaefer N, Andrews ND, Pornsrinsiyom D, Moul DE, Sun Z, Bena J. Sleep apnea and epilepsy: who's at risk? Epilepsy Behav. 2012;25:363—7.
31. Manni R, Terzaghi M, Arbasino C, Sartori I, Galimberti CA, Tartara A. Obstructive sleep apnea in a clinical series of adult epilepsy patients: frequency and features of the comorbidity. Epilepsia. 2003;44:836—40.