Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.

This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

http://www.elsevier.com/copyright

Author's personal copy

Sleep Medicine 11 (2010) 999–1009

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Daytime consequences of insomnia symptoms among outpatients in primary care practice: EQUINOX international survey

Damien Léger [a,*], Markku Partinen [b], Max Hirshkowitz [c], Sudhansu Chokroverty [d], Evelyne Touchette [a], Jan Hedner [e], on behalf of the EQUINOX (Evaluation of daytime QUality Impairment by Nocturnal awakenings in Outpatients eXperience) survey investigator group

[a] Université Paris Descartes, APHP, Centre du Sommeil et de la Vigilance, de Hôtel Dieu de Paris, Paris, France
[b] Skogby Sleep Clinic, Rinnekoti Research Centre, Espoo, Finland
[c] Sleep Disorders and Research Centre, VA Medical Centre, Houston, TX, USA
[d] New Jersey Neuroscience Institute, JFK Medical Centre, Edison, NJ, USA
[e] Sleep Laboratory Unit, Department of Respiratory Medicine and Allergology, Sahlgrenska University Hospital, Göteborg, Sweden

ARTICLE INFO

Article history:
Received 8 December 2009
Received in revised form 7 April 2010
Accepted 30 April 2010
Available online 20 October 2010

Keywords:
Insomnia
Difficulty initiating sleep
Difficulty maintaining sleep
Early morning awakening
Non-restorative sleep
Daytime consequences
International survey

ABSTRACT

Objective: To assess the daytime consequences in outpatients suffering from different insomnia symptoms in primary care practice.
Methods: An international cross-sectional survey was conducted in 5293 outpatients complaining of sleep disturbances in primary care practice. A sleep questionnaire addressing daytime consequences, insomnia symptoms, socio-demographic characteristics, and other sleep variables was administered by 647 physicians in 10 countries.
Results: Overall, 20–33% of subjects reported "severe" daytime impairments associated with sleep disturbances. Approximately 45% of patients complaining of sleep disturbances in primary care practice suffered from a combination of insomnia symptoms. Patients suffering from all insomnia symptoms reported the most severe daytime functioning impairments compared with patients suffering from initiation or maintenance insomnia only. Conversely, the majority of patients suffering from non-restorative sleep reported little daytime functioning impairments compared to the patients suffering from other combinations of insomnia symptoms. The strongest risk factor associated with "severe" daytime functioning impairments was sleep quality perception.
Conclusions: Primary insomnia disturbs subjective daytime functioning. A report of combined insomnia symptoms reflected the most damaging insomnia subtype and had a negative impact on a wide range of daytime functioning consequences.

© 2010 Elsevier B.V. All rights reserved.

1. Introduction

Insomnia is the most frequent sleep complaint associated with negative daytime consequences.[1] Despite the high prevalence of insomnia symptoms related to severe daytime impairments, only a few epidemiological studies have addressed the relative occurrence of lifestyle impairments in different domains of daytime consequences. Zammit et al.[2] reported that people with insomnia reported significantly worse occupational functioning compared to people without insomnia. In cognitive spheres, laboratory studies generally found no deficit on psychomotor tasks among insomniacs. This may be explained by a capacity in insomniacs to sustain adequate performance for a short experimental situation.[3,4] However, cognitive deficits may be revealed in occupational life situations that require more extended periods of performance. In emotional domains, it is well-known that depression symptoms could produce insomnia[5], insomnia symptoms could be a precursor of depression,[6] and thus these two problems could impair daytime functioning. To our knowledge, there has been no survey that simultaneously measured occupational, cognitive, and emotional domains of subjective daytime functioning related to sleep disturbances across different geographical and cultural regions.

Although several studies have explored daytime repercussions of insomnia (e.g., sleepiness, irritability, or depressive mood)[6–14], the daytime consequences resulting from different types of insomnia symptoms — difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS)[15,16], early morning awakenings (EMA), and non-restorative sleep (NRS) — or from a combination of insomnia symptoms[17,18], were relatively unexplored in most epidemiologi-

* Corresponding author. Address: Université Paris Descartes, APHP Hotel Dieu de Paris, Centre du Sommeil et de la Vigilance, 1 place du parvis Notre Dame, 75181 Paris, Cedex 04, France. Tel.: +33 1 42 34 82 43; fax: +33 1 42 34 82 27.
E-mail address: damien.leger@htd.aphp.fr (D. Léger).

1389-9457/$ - see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.sleep.2010.04.018

Author's personal copy

cal studies on insomnia. Most previous studies evaluating daytime consequences in patients with insomnia treated samples as a homogeneous rather than heterogeneous group. People suffering from subjective complaints of insomnia may differ by the nature of their complaint (initiation vs. maintenance). To our knowledge, there is no study that assessed "severe" daytime consequences into separated subgroups of insomnia symptoms.

Several well-identified risk factors for insomnia have been reported. Gender is the best characterised demographic risk factor, with an increased prevalence in women.[19] In addition, comorbid sleep disorders such as a sleep-related breathing disorder[20], restless legs syndrome[21], and working night or rotating shifts[22] also represent risk factors for insomnia. However, it is generally recognized that several potential socio-demographic characteristics, sleep variables, and insomnia symptoms fail to clearly predict severe daytime functioning consequences.

There were two objectives of the present study. The first aim was to compare the daytime consequences between different subgroups of patients complaining of various insomnia symptoms. The second aim was to identify factors associated with the occurrence of "severe" daytime consequences related to sleep disturbances. We hypothesized that patients complaining of DMS will have a more severe negative impact on daytime consequences compared with patients suffering from DIS. Finally, we expected that the occurrence of severe negative impact of daytime consequences may be explained mainly by insomnia symptoms.

2. Methods

2.1. Design

The present study reports the results of an international cross-sectional survey conducted between September 2005 and September 2006 in outpatients suffering from sleep disturbances consulting in primary care offices across 10 countries. The present paper is the second of a series of publications. The general objective was to address specific aspects of daytime consequences in function as various insomnia symptoms. Methodological issues and frequency of sleep disturbances have already been presented in a previous article, to which readers should refer for further details.

The usual care management of the patient was not modified by the completion of the survey. Approvals were obtained in accordance with local regulations for each country for specific data protection laws. A written informed consent, translated into the local language, was obtained from each patient prior the interview and the completion of the questionnaire.

2.2. Physicians

A total of 647 physicians and 10 countries (Finland, Sweden, Switzerland, Greece, Portugal, Morocco, Mexico, Jordan, Lebanon, and Philippines) participated in the survey. Physicians were mainly general practitioners (GP), specialists in family medicine or internists. A participating centre had to be office-based unless this was inconsistent with the local Health Care System organization. The participation of the physicians to fill out the survey was based on their agreement of the protocol and on their previous collaboration with Sanofi-Aventis Sponsor.

Guidelines have been nationally provided to select a representative sample of GPs based on the statistics of each country regarding age, sex ratio, urban vs. rural practice. These guidelines have been applied for 10 countries. The recruitment of each GP for the study has been built to be as representative as possible of typical patients' GP files across the countries.

2.3. Selection of the patients

All subjects consulting their physician during two consecutive working days of the first week following the survey initiation in the centre (or after the investigator's meeting) completed an anonymous "patient log form," except for Greece, Portugal, Sweden and Switzerland, due to local procedures. In these last countries, the name of participants was known by GPs but was treated anonymously before being included in the international analysis. The inclusion eligibility criteria for participating at the survey were as follows: (a) 18 years of age or older; (b) presence of a sleep disorder according to a spontaneous complaint or upon a question from the physician; and (c) no previous history of treatment with a sleep promoting agent (e.g., benzodiazepin receptor agonist, tranquillizer, anxiolytic, antihistamine and melatonine agonist) or an antidepressant within the 4 weeks preceeding the completion of the questionnaire. The physician had to obtain written informed consent of each subject before continuing any further investigations.

2.4. Measurements

2.4.1. Patient Log Forms

Data collected on the Patient Log Forms included sex, age, presence of sleep disorders, treatment for sleep disorders, and inclusion in the sleep survey. Insomnia was defined according to the DSM-IV definition. In addition, the definition of the American Academy of Sleep Medicine (AASM) Working Group was used for exploratory purposes (Edinger, 2004).

2.4.2. Sleep questionnaire

Nine domains of daytime consequences associated with sleep difficulties were assessed using the following questions: "Do your sleep problems have a negative impact on (1) your daily activities?" (2) your work activities? (3) your relationships with other persons? (4) your leisure activities? (5) your memory capability? (6) your concentration capability? (7) your mood during the day, making you feel tense? (8) your mood during the day, making you feel irritable? (9) your mood during the day, making you feel depressed? Each question was assessed on a 6-point Likert scale (0 = no, 5 = very high). Intensity of each daytime consequence was categorized as follows: no or mild if the answer was rated "0" or "1"; moderate if the answer was rated "2" or "3"; severe if the answer was rated "4" or "5." The sleep questionnaire measured the four insomnia symptoms defined as difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), early morning awakening (EMA), and having non-restorative sleep (NRS) at least 2–3 times a week for at least 1 month.

2.5. Comorbidities

The questionnaire included several items allowing us to describe psychiatric comorbidities and other sleep disorders.

Psychiatric comorbidities were assessed both by patients' feelings and by the physician willing to treat.

- Patients had to rate between 0, "No," up to 5, "very high," the following items: Q7, "Do your sleep problems have a negative impact during the day making you feel tense?"; Q9, "Do your sleep problems have a negative impact on your mood during the day, making you feel depressed?" Based on these items, we supposed that subjects answering "high or very high" to these questions could be considered anxious (Q7) or depressed (Q9), respectively.
- Physicians had also to give their feeling on how they are willing to treat the patients. Patients treated by anxiolytics were considered anxious and patients treated by anti-depressants were considered depressive.

Author's personal copy

2.5.1. Other sleep disorders

Patients were interviewed with the following: (Q1) "Have you ever been told that you suffer from snoring loudly, sleep apnea, restless legs syndrome (RLS)?" The international criteria for RLS were also written in the questionnaire for a better diagnosis.

2.6. Potential risk factors

Putative factors associated with the occurrence of "severe" daytime consequences were also assessed by the sleep questionnaire. Each categorical factor was dichotomized and coded to represent risk as (1) compared to a reference category (0). Among the socio-demographic variables, 11 potential variables were considered: [1] sex of the patient, coded as (1) for female and (0) for male; [2] age (quantitative variable); [3] presence of obesity defined as >30 kg/m^2; [4] living with other people; [5] having an unemployed/retired status; [6] being a shift worker; [7] living in rural region; [8] living in a noisy environment; [9] being a morning type; [10] having a drivers license; and [11] country (Switzerland was the reference country). Among the sleep characteristics, 17 potential variables were considered: (1) presence of DIS, (2) presence of DSM, (3) presence of EMA, (4) presence of NRS, (5) frequency of sleep disturbances (>3 nights per week), (6) history of sleep disturbances ($\geqslant$1 month), (7) wake-up rested/unrested (six points scale where 0 = completely rested, 5 = completely unrested, 4–5 vs. 0–3), (8) sleep satisfaction (six points scale where 0 = completely satisfactory, 5 = completely unsatisfactory, 4–5 vs. 0–3), (9) sleep quality (six points scale where 0 = excellent, 5 = dreadful, 4–5 vs. 0–3), (10) sleep duration sufficiency (four points scale where 0 = very sufficient, 3 = very insufficient, 3 vs. 0–2), (11) perceived time in bed (quantitative variable), (12) number of perceived sleeping hours (quantitative variable), (13) snoring loudly, (14) sleep apnea, (15) restless legs syndrome, (16) taking herbal preparation, and (17) drinking alcohol to promote sleep.

2.7. Data management and statistical analyses

Data collection and validation procedures and data quality control ensured the quality of the study database. Collected data were analysed in a single independent statistical centre. The analysis was made according to a pre-defined statistical plan using SAS software Version 9-1. Analyses were performed on the entire population sample covering 10 countries.

Chi-square tests were used to compare the differences between insomnia subgroups on daytime consequence intensity (e.g., absent or mild, moderate, severe). For each domain of daytime consequences, multiple logistic regression was performed to compute odds ratios in order to identify the factors associated the most with the occurrence of a "severe" intensity, rated 4 or 5 (high or very high negative impact), compared to "not severe," rated 0–3 (no to moderate negative impact). Decision criteria were Wald Chi-square tested and stepping was stopped when there were no further candidate variables that entered the model at the 5% significance level. All statistical analyses were performed at the 5% significance level.

3. Results

3.1. Sample characteristics

The sleep survey was completed by a total of 5544 subjects. Of these, 5515 were entered in the database (informed consent was not available for 28 subjects and one subject had completed the inclusion criteria section). Out of the 5515 subject reports included in the database, 222 contained either major deviations or missing data and were excluded from the analyses. Hence, 5293 subjects were included in the analyses. The participation rate was 95.5%. The percentages of patients included in the analyses for the different countries were as follows (number, relative contributions): Mexico (n = 1378, 26.0%), Morocco (n = 1120, 21.2%), Finland (n = 536, 10.1%), Portugal (n = 525, 9.9%), Philippines (n = 496, 9.4%), Greece (n = 387, 7.3%), Switzerland (n = 328, 6.2%), Sweden (n = 293, 5.5%), Lebanon (n = 176, 3.3%), and Jordan (n = 54, 1.0%). The sample of patients who completed the sleep questionnaire (n = 5293) was predominantly female (63.9%) with a mean age of 47.9 ± 15.3 years. The socio-demographic characteristics and the most relevant demographic differences between countries have been noted elsewhere [unpublished observations].

The subjects were supposed to be representative of the usual GP file. Compared to the non-insomniacs, insomniacs were older (45 years old vs. 35 years old; $P < 0.001$) and the sex ratio was predominantly female (65% of the insomniacs vs. 60% of the non-insomniacs; $P < 0.001$).

3.2. Frequency of severe daytime consequences

Overall, 20–33% of subjects reported a "severe" negative daytime consequence associated with the sleep disturbance. The mean intensity scores ranged from 2.2 to 2.6 on the 6-point categorical scales. Impact on mood, making the subject either tense or irritable, were considered as severe by more subjects compared to the other daytime consequences, e.g., feeling tense: 32.6% (2.7 ± 1.4), feeling irritable: 31.8% (2.6 ± 1.4), on concentration: 27.8% (2.5 ± 1.4), on daily activities: 27.6% (2.6 ± 1.3), on memory capability: 26.3% (2.4 ± 1.5), feeling depressed: 26.1% (2.2 ± 1.6), on working activities: 22.3% (2.4 ± 1.4), on leisure activities: 21.6% (2.2 ± 1.5), and on relationships: 20.4% (2.2 ± 1.4).

3.3. Insomnia and daytime consequences

The frequency of sleep disorders other than insomnia was estimated at 32.6%. The subgroups of patients suffering from various combinations of insomnia symptoms are shown in Fig. 1. Five separate combinations of symptoms were taken into account to compare the impact on "severe" daytime impairments: (1) a subgroup suffering from the most frequent combination of insomnia symptoms (45.2%) comprising these three insomnia symptoms combined (DIS + DMS + EMA) with or without (±) reporting NRS, (2) a subgroup suffering from DIS (±NRS) represented by 8.5% of the patients, (3) a subgroup suffering from DMS (±NRS) comprising 6.3% of the patients, (4) a subgroup suffering from EMA (±NRS) comprising 2.5% of patients, and (5) a subgroup suffering from NRS only reported by 1.4% of the patients. For all daytime consequences, there was a statistically significant difference ($P < 0.0001$) between subgroups of subjects with sleep disturbances (Table 1). The higher percentage of severe daytime consequences was found in the subgroup reporting all insomnia symptoms combined (DIS + DMS + EMA ± NRS). Conversely, a higher percentage of no/mild daytime consequences were found in the subgroup of subjects presenting only NRS compared to the other subgroups of insomnia symptoms (except for concentration).

We try to make the analyses comparing the differences between each complaint independently of their combinations. However, as it could be viewed in the figure, the number of subjects in each insomnia subgroup is too low to allow enough statistical power for the comparison. This is why we decided to group insomnia symptoms (DIS, DMS, and EMA) with NRS.

3.4. Factors associated with "severe" daytime consequences related to sleep disturbances

The results of multiple logistic regressions are expressed in Table 2 which includes for each daytime consequence the seven most

Author's personal copy

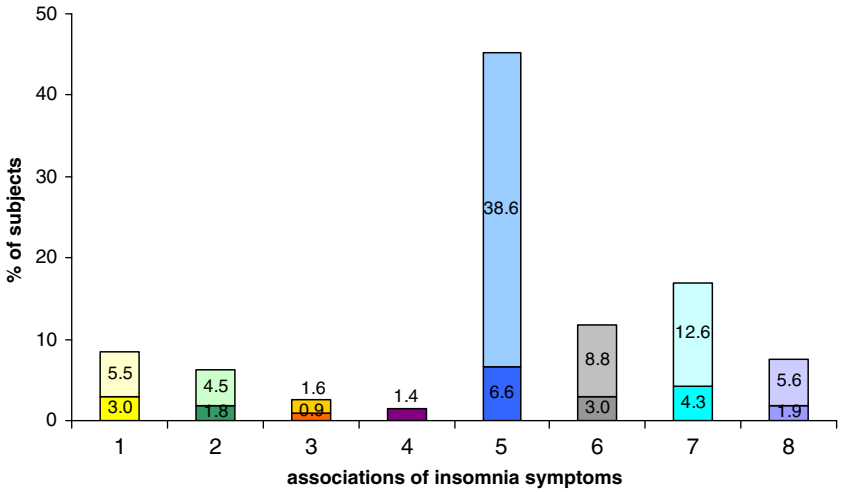

Fig. 1. Prevalence of subjects suffering from different associations of insomnia symptoms. DIS: difficulty initiating sleep, DMS: difficulty maintaining sleep, EMA: early morning awakenings, and NRS: non-restorative sleep. The darker color of each histogram bar does not include the NRS symptom, whereas the lighter color includes NRS. 1 = DIS (dark yellow), DIS + NRS (light yellow); 2 = DMS (dark green), DMS + NRS (light green); 3 = EMA (dark orange), EMA + NRS (light orange); 4 = NRS (dark purple); 5 = DIS + DMS + EMA (dark blue), DIS + DMS + EMA + NRS (light blue); 6 = DMS + EMA (dark grey), DMS + EMA + NRS (light grey); 7 = DIS + DMS (dark turquoise), DIS + DMS + NRS (light turquoise); 8 = DIS + EMA (dark violet), DIS + EMA + NRS (light violet). (For interpretation of the references in colour in this figure legend, the reader is referred to the web version of this article.)

Table 1
Daytime consequences intensity between different subgroups of subjects complaining with various insomnia symptoms.

Negative impact on		DIS +/− NRS	DMS +/− NRS	EMA +/− NRS	NRS	DIS + DMS + EMA +/− NRS	Total
Daily activities	*N*	450	334	133	75	2392	3384
	No/mild	132 (29.33%)	96 (28.74%)	45 (33.83%)	38 (50.67%)	356 (14.88%)	667 (19.71%)
	Moderate	235 (52.22%)	181 (54.19%)	72 (54.14%)	26 (34.67%)	1195 (49.96%)	1709 (50.50%)
	Severe	83 (18.44%)	57 (17.07%)	16 (12.03%)	11 (14.67%)	841 (35.16%)	1008 (29.79%)
	P-value						*P* < 0.0001
Work activities (if worker)	*N*	316	236	98	63	1385	2098
	No/mild	98 (31.01%)	83 (35.17%)	39 (39.80%)	33 (52.38%)	274 (19.78%)	527 (25.12%)
	Moderate	163 (51.58%)	124 (52.54%)	47 (47.96%)	23 (36.51%)	716 (51.70%)	1073 (51.14%)
	Severe	55 (17.41%)	29 (12.29%)	12 (12.24%)	7 (11.11%)	395 (28.52%)	498 (23.74%)
	P-value						*P* < 0.0001
Relationships	*N*	450	334	133	75	2392	3384
	No/mild	171 (38.00%)	147 (44.01%)	64 (48.12%)	43 (57.33%)	562 (23.49%)	987 (29.17%)
	Moderate	218 (48.44%)	152 (45.51%)	53 (39.85%)	26 (34.67%)	1212 (50.67%)	1661 (49.08%)
	Severe	61 (13.56%)	35 (10.48%)	16 (12.03%)	6 (8.00%)	618 (25.84%)	736 (21.75%)
	P-value						*P* < 0.0001
Leisure activities	*N*	450	334	133	75	2392	3384
	No/mild	184 (40.89%)	160 (47.90%)	70 (52.63%)	41 (54.67%)	650 (27.17%)	1105 (32.65%)
	Moderate	203 (45.11%)	135 (40.42%)	51 (38.35%)	31 (41.33%)	1096 (45.82%)	1516 (44.80%)
	Severe	63 (14.00%)	39 (11.68%)	12 (9.02%)	3 (4.00%)	646 (27.01%)	763 (22.55%)
	P-value						*P* < 0.0001
Memory capability	*N*	450	334	133	75	2392	3384
	No/mild	174 (38.67%)	150 (44.91%)	59 (44.36%)	37 (49.33%)	475 (19.86%)	895 (26.45%)
	Moderate	197 (43.78%)	129 (38.62%)	55 (41.35%)	29 (38.67%)	1131 (47.28%)	1541 (45.54%)
	Severe	79 (17.56%)	55 (16.47%)	19 (14.29%)	9 (12.00%)	786 (32.86%)	948 (28.01%)
	P-value						*P* < 0.0001
Concentration	*N*	450	334	133	75	2392	3384
	No/mild	154 (34.22%)	132 (39.52%)	55 (41.35%)	28 (37.33%)	427 (17.85%)	796 (23.52%)
	Moderate	210 (46.67%)	147 (44.01%)	56 (42.11%)	34 (45.33%)	1141 (47.70%)	1588 (46.93%)
	Severe	86 (19.11%)	55 (16.47%)	22 (16.54%)	13 (17.33%)	824 (34.45%)	1000 (29.55%)
	P-value						*P* < 0.0001
Feel tense	*N*	450	334	133	75	2392	3384
	No/mild	142 (31.56%)	114 (34.13%)	56 (42.11%)	33 (44.00%)	344 (14.38%)	689 (20.36%)
	Moderate	209 (46.44%)	149 (44.61%)	54 (40.60%)	31 (41.33%)	1064 (44.48%)	1507 (44.53%)
	Severe	99 (22.00%)	71 (21.26%)	23 (17.29%)	11 (14.67%)	984 (41.14%)	1188 (35.11%)
	P-value						*P* < 0.0001

DIS: difficulty initiating sleep; DMS: difficulty maintaining sleep. EMA: early morning awakening; NRS: non-restorative sleep.

significant factors associated with severe daytime consequences. Surprisingly, the insomnia symptoms (DIS, DMS or NRS) did not appear to have a significant impact after regression. Conversely, subjective assessments such as "waking unrested, poor sleep

Author's personal copy

quality, sleep duration insufficiency or sleep dissatisfaction" were significantly associated with severe daytime consequences. EMA had also a modest but significant impact.

Among socio-demographic characteristics, different geographic localisations were found to influence the risk of suffering from severe daytime consequences related to sleep disturbances. For example, patients living in Philippines reported more "severe" daytime consequences related to sleep disturbance in their daily activities, memory capability, concentration, and feeling depressed, whereas patients living in Portugal, Mexico, Morocco, Finland, and Sweden were less likely to have "severe" impairments on daytime consequences related to sleep disturbances compared to Switzerland, the reference country. In addition, having an older age was associated with a reduced risk of suffering from "severe" impairment in several domains, such as relationships, leisure activities, and mood disturbances (feeling tense and irritable). Moreover, being employed was found to be a protective factor of not presenting "severe" impact on daytime cognitive spheres (memory capability and concentration) and mood disturbances (feeling depressed). Finally, living in a noisy environment was significantly associated with severe daytime consequences in work activities.

3.5. Psychiatric comorbidities and other sleep disorders (sleep apnea and RLS)

According to the patients, 79% rated "high/very high" on feeling tense and 64% rated "high/very high" on "feeling depressed" during the daytime. According to medical prescriptions, 22.7% of insomniacs were treated by anxiolytics and 22% by anti-depressants.

When subjects were interviewed about diagnosed sleep disorders 10% of insomniacs said they had been diagnosed with sleep apnea and 20% with RLS. Table 3 reported univariate explicative variables, reported by odds ratio (OR), which may explain daytime consequences in relation to psychiatric items and self-reported sleep disorders. Feeling tense or depressed had a major impact on daytime consequences, particularly on relationships (OR = 10.0 [7.2–14.0] for feeling tense and 7.2 [5.8–8.9] for feeling depressed) but also on cognitive functioning (memory and concentration), leisure and work activities. Doctors willing to treat by anti-depressants or by anxiolytics was significantly linked to daytime impairment, but less strongly, with an impact on work activities OR = 3.5 [2.8–4.5] and on relationships: OR = 2.7 [2.2–3.3]. However, self-reported sleep apnea and RLS had a modest impact on daytime consequences.

Table 4 presents the results of multivariate analyses exploring the factors associated the most with severe negative impact on daytime consequences when daytime consequences for «feeling tense» are moderate or severe (Table 4a) and when daytime consequences for «feeling depressed» are moderate or severe (Table 4b). Sleep duration insufficiency was non-significant for all analyses. The analyses found that whatever the comorbidity (sleep apnea or restless legs) or condition deduced from the questionnaire (feeling tense or feeling depressed), the factors most strongly associated with daytime consequences were also subjective sleep self-assessments, such as poor sleep quality and sleep dissatisfaction.

4. Discussion

This is the first international study attempting to measure simultaneously subjective daytime consequences in many domains among different insomniac subgroups with a wide range of potential explicative variables. First, the incidence of insomnia is highly prevalent in primary care patients around the world (32.6%). This incidence corroborates a general consensus suggested by population-based studies that 30% of adults from different countries reported one or more of the symptoms of insomnia: difficulty initiating sleep, difficulty maintaining sleep, waking up too early, and/or non-restorative sleep.[23]

The subgroup of patients suffering from the all symptoms group had the greatest associations with daytime functional impairments. In addition, the results showed that the subjects presenting only non-restorative sleep have little daytime consequences compared to the other insomnia subgroups of symptoms. Non-restorative sleep (NRS) is the most recent insomnia symptom incorporated in the DSM-IV.[24] Indeed, the presence of NRS as an insomnia symptom should be discussed here with caution because it could be related to a deliberate self-inflicted sleep deprivation, especially during work hours, that could explain the least negative impact on daytime consequences compared to other subgroups.

As demonstrated in Table 2, all domains of "severe" daytime consequences were highly and significantly associated with sleep quality perception (waking-up unrested, poor sleep quality, sleep duration insufficiency, and sleep dissatisfaction). Different hypotheses were proposed here to explain these associations. A series of studies have supported the hyperarousal theory that chronic physiological arousal might impair both sleep and daytime functioning.[25] Surprisingly, most studies found that insomniacs were not sleepier during the day compared to non-insomniacs measured by multiple sleep latency test (MSLT).[4,26] However, sleep disturbances may produce fatigue and/or mood disturbances sufficient to interfere with general daytime functioning. Another possibility might be that insomnia complaints result from a misperception of both sleep needs and daytime functioning level. It was well-documented that patients with insomnia are more concerned about their sleep impairments compared with non-insomniacs.[27,28] It has been suggested that insomniacs subjectively overestimate their daytime deficits.[1]

Among all insomnia symptoms, reporting EMA revealed to be significantly associated with severe daytime functioning impairments. Other insomnia symptoms, such as DIS, DMS, and NRS were not associated with severe daytime functioning impairments. It could be explained that these insomnia symptoms were highly correlated with important subjective questions (e.g., feeling unrested, poor sleep quality). The frequency of sleep disturbances (>3 nights per week) were significantly associated with two major domains of daytime functioning impairments, such as daily and work activities, which corroborates the utilization of this frequency criteria in the DSM-IV definition.

Among socio-demographic characteristics, gender was not an important risk factor of having severe daytime impairments after taking into account many potential factors. The risk of suffering from insomnia for a woman is approximately 1.5–2-fold higher than that of a man[11,30] but this suggests that women did not report more subjective daytime consequences compared to men. The present study reported a variability of severe daytime consequences related to sleep disturbances between countries. People living in the Philippines reported more subjective daytime consequences, whereas other countries such as Mexico, Portugal, Morocco, Finland, and Sweden reported less severe daytime impairments compared to Switzerland. Cultural differences associated with severe daytime consequences related to sleep disturbances were not well studied. Alattar et al. found that Latinos were less likely than Whites to report impairments during daily activities.[31] Increases in age decreased the risk of suffering from severe impairments in leisure activities, relationships, and irritability. This result could be explained by retirement among older patients, and therefore it suggests they have more time for leisure times and relationships that could reduce their irritability. Having a job decreased the risk of suffering from severe daytime impairments in concentration, memory capability and depression, important spheres related to performance at work. Indeed, Léger et al.[32]

Author's personal copy

Table 2
Factors associated the most with severe negative impact on daytime consequences related to sleep disturbances (seventh factors).

Daytime consequences	Variables									
	Wake-up unrested	Poor sleep quality	Sleep duration insufficiency	Sleep dissatisfaction	EMA insomnia symptom	⩾3 Nights per week	Country	Age	Employment (full time)	Noisy environment
Daily activities	1	2	5	3	7	6	4			
Rank	3.0	2.6	2.2	2.0	1.3	1.4	Ph: 1.8 [1.3–2.6]			
OR [95% CI]	[2.4–3.9]	[2.0–3.3]	[1.6–2.9]	[1.6–2.4]	[1.1–1.6]	[1.2–1.7]	Pt: 0.5 [0.4–0.8]			
Work activities	1	2	3	4		5	6			7
	2.6	2.1	2.1	2.0		1.7	Mx: 0.5			1.5
	[1.9–3.7]	[1.6–2.7]	[1.6–2.6]	[1.5–2.6]		[1.3–2.1]	[0.3–0.8]			[1.2–1.9]
Relationships	1	2	5	7	4		6	3		
	2.7	2.6	1.5	1.5	1.4		Pt: 0.7	0.98		
	[2.1–3.5]	[2.0–3.3]	[1.3–1.8]	[1.2–1.8]	[1.2–1.6]		[0.5–1.0]	[0.98–0.99]		
Leisure activities	1	2	4	7	6		3	5		
	2.5	2.5	2.2	1.5	1.4		Mx: 0.6 [0.4–0.8]	0.99		
	[1.9–3.1]	[1.9–3.2]	[1.6–2.9]	[1.2–1.8]	[1.2–1.7]		Pt: 0.3 [0.2–0.5]	[0.98–0.99]		
							Ma: 0.5 [0.4–0.7]			
Memory capability	1	2	3	5	7		6		4	
	2.3	1.6	2.3	1.7	1.2		Ph: 1.7		0.8	
	[1.8–2.9]	[1.3–1.9]	[1.7–3.1]	[1.4–2.0]	[1.1–1.5]		[1.2–2.4]		[0.7–0.9]	
Concentration	3	2	6	1	5		7		4	
	2.2	1.6	1.6	2.6	1.4		Ph: 1.9		0.7	
	[1.6–2.9]	[1.3–1.9]	[1.3–1.9]	[1.8–3.7]	[1.1–1.6]		[1.3–2.7]		[0.6–0.8]	
Feel tense	2	1	4	7	3		5	6		
	2.5	3.1	1.8	1.4	1.4		Mx: 0.6 [0.5–0.9]	0.99		
	[2.0–3.3]	[2.4–4.0]	[1.4–2.3]	[1.2–1.7]	[1.2–1.6]		Pt: 0.6 [0.4–0.8]	[0.98–0.99]		
							Ma: 0.6 [0.4–0.8]			
							Se: 0.6 [0.4–0.8]			
							Fi: 0.6 [0.4–0.9]			
Feel irritable	2	1	3	6	5		4	7		
	2.2	2.6	2.1	1.5	1.7		Mx: 0.7	0.99		
	[1.7–2.9]	[2.0–3.4]	[1.6–2.7]	[1.2–1.8]	[1.3–1.7]		[0.5–1.0]	[0.98–0.99]		
Feel depressed	1	2	3	7	6		4		5	
	2.7	2.2	2.6	1.5	1.4		Ph: 2.1		0.7	
	[2.1–3.4]	[1.7–2.8]	[2.0–3.5]	[1.2–1.8]	[1.2–1.7]		[1.4–2.9]		[0.6–0.8]	

In this table are presented the seven most significant factors associated after multiple regressions with severe daytime consequences of insomnia. The ranks (from 1 to 7) are expressed at the top of each square.
OR signifies odd ratio. 95% CI: 95% confidence interval. EMA: "wake up to early in the morning". Country: Ph: Philippines; Ma: Morocco; Mx: Mexico; Pt: Portugal; Se: Sweden; Fi: Finland; and the reference category was Switzerland.
Severe daytime consequences = very high or high negative impact (scores 4 or 5) vs. no to moderate negative impact (scores 0–3). Explicative variables were dichotomized as followed; the reference category being the absence of the symptom: wake-up unrested: unrested (score 5) vs. rested (scores 0–3).
Poor sleep quality: dreadful (score 5) vs. excellent (scores 0–3) except for work activities and memory capability (scores 4 or 5 vs. 0–3). Sleep dissatisfaction: dissatisfied (scores 4 or 5) vs. satisfied (scores 0–3) except for concentration (score 5 vs. scores 0–2), sleep duration insufficiency: insufficient (score 3) vs. sufficient (scores 0–2) except for memory capability, feeling tense, feeling irritable and feeling depressed (score 3 vs. scores 0 or 1). EMA: yes vs. no. Employment: unemployed vs. employed for memory capability and full time employed vs. unemployed for concentration. Frequency sleep disturbances: >3 nights vs. ⩽3 nights per week.
Age: increase of 1 year. Ranks mean that this variable has been ranked from the most to the least significant.

Table 3
Psychiatric items, self-reported sleep disorders and daytime consequences: explicative variables (unidimensional results expressed by odds ratio).

Daytime consequences OR [95% CI]	Explicative variables						
	Feeling tense	Feel depressed	Sleep apnea	Restless legs syndrome	Prescription of*		
					Only anxiolytic	Only anti-depressant	Both anxiolytic and anti-depressant
	Moderate severe/absent mild	Moderate severe/absent mild	Yes/no	Yes/no			
Daily activities	6.3 [5.0–7.9]	5.4 [4.6–6.4]	1.5 [1.2–1.8]	1.3 [1.1–1.5]	1.5 [1.3–1.7]	2.0 [1.6–2.4]	2.7 [2.2–3.3]
Work activities (if worker)	6.6 [4.8–9.2]	7.3 [5.7–9.4]	1.3 [1.0–1.7]	1.1 [0.9–1.4]	1.4 [1.1–1.8]	2.3 [1.8–3.0]	3.5 [2.8–4.5]
Relationships	10.0 [7.2–14.0]	7.2 [5.8–8.9]	1.5 [1.2–1.8]	1.3 [1.1–1.5]	1.3 [1.1–1.5]	1.8 [1.5–2.3]	2.7 [2.2–3.3]
Leisure activities	7.7 [5.7–10.2]	6.4 [5.2–7.8]	1.3 [1.0–1.6]	1.4 [1.2–1.6]	1.1 [0.9–1.3]	2.0 [1.6–2.4]	2.4 [2.0–3.0]
Memory capability	8.3 [6.3–10.7]	6.8 [5.6–8.1]	1.5 [1.2–1.8]	1.4 [1.2–1.6]	1.2 [0.99–1.4]	2.0 [1.6–2.4]	2.6 [2.2–3.2]
Concentration	8.5 [6.6–11.0]	6.4 [5.3–7.6]	1.3 [1.1–1.6]	1.3 [1.1–1.5]	1.1 [0.97–1.3]	2.1 [1.8–2.6]	2.8 [2.3–3.4]
Feeling tense		8.1 [6.9–9.6]	1.2 [1.0–1.5]	1.3 [1.2–1.5]	1.4 [1.2–1.7]	2.4 [2.0–2.9]	3.0 [2.5–3.7]
Feel irritable	27.5 [18.7–40.5]	8.1 [6.8–9.6]	1.2 [1.0–1.5]	1.2 [1.1–1.4]	1.5 [1.3–1.7]	2.4 [2.0–2.9]	3.1 [2.6–3.8]
Feel depressed	11.1 [8.2–14.9]		1.2 [0.98–1.5]	1.4 [1.2–1.6]	1.3 [1.1–1.5]	4.7 [3.8–5.7]	4.9 [4.0–5.9]

OR signifies odd ratio. 95% CI: 95% confidence interval.
* Reference category: no anxiolytic and no anti-depressant.

Author's personal copy

Author's personal copy

Table 4a
Factors associated the most with severe negative impact on daytime consequences when daytime consequences for «Feeling tense» are moderate or severe $N = 4054$ (if worker $N = 2572$).

Daytime consequences OR [95% CI]	Explicative variables								
	Wake-up unrested	Poor sleep quality	Sleep dissatisfaction	EMA insomnia symptom	>3 Nights per week	Country	Age	Employment (full time)	Noisy environment
Daily activities Severe negative impact (33.1% of feeling tense)	2.1 [1.8–2.6]	2.1 [1.7–2.5]	2.3 [1.9–2.8]	1.4 [1.2–1.7]	1.6 [1.3–1.9]	Ma: 1.5 [1.1–2.0] Ph: 1.5 [1.0–2.2] Pt: 0.5 [0.3–0.8]	NS	NS	NS
Work activities (if worker) Severe negative impact (27.1% of feeling tense)	1.6 [1.2–2.1]	2.3 [1.8–2.9]	2.3 [1.7–2.9]	1.4 [1.1–1.7]	1.8 [1.4–2.3]	NS	NS	NS	1.4 [1.1–1.7]
Relationships Severe negative impact (25.2% of feeling tense)	2.0 [1.6–2.5]	1.9 [1.6–2.4]	1.7 [1.3–2.1]	1.4 [1.2–1.7]	1.3 [1.0–1.5]	Pt: 0.7 [0.4–1.0]	0.99 [0.980–0.991]	0.8 [0.7–1.0]	NS
Leisure activities Severe negative impact (26.3% of feeling tense)	1.9 [1.5–2.3]	1.8 [1.5–2.2]	1.8 [1.4–2.2]	1.5 [1.2–1.8]	NS	Mx: 0.6 [0.4–0.9] Pt: 0.3 [0.2–0.5] Ma: 0.6 [0.5–0.9]	0.99 [0.983–0.994]	1.3 [1.1–1.5]	NS
Memory capability Severe negative impact (32.1% of feeling tense)	1.6 [1.4–2.0]	1.6 [1.3–1.9]	1.8 [1.5–2.2]	1.3 [1.1–1.5]	1.3 [1.1–1.5]	Ph: 1.7 [1.2–2.4]	1.01 [1.004–1.015]	0.8 [0.6–0.9]	NS
Concentration Severe negative impact (33.6% of feeling tense)	1.7 [1.4–2.0]	1.7 [1.4–2.0]	1.6 [1.3–1.9]	1.4 [1.2–1.6]	1.3 [1.1–1.5]	Ph: 1.4 [1.0–2.0]	NS	0.7 [0.6–0.8]	NS
Feeling tense Severe negative impact (41.4% of feeling tense)	1.7 [1.4–2.0]	2.2 [1.9–2.6]	1.6 [1.3–1.9]	1.4 [1.2–1.6]	1.2 [1.0–1.4]	Pt: 0.6 [0.4–0.8]	0.99 [0.986–0.996]	0.8 [0.7–0.9]	NS
Feel irritable Severe negative impact (40.0% of feeling tense)	1.7 [1.4–2.1]	2.0 [1.7–2.4]	1.6 [1.4–2.0]	1.5 [1.2–1.7]	1.3 [1.1–1.5]	NS	0.99 [0.986–0.996]	0.8 [0.7–0.9]	NS
Feel depressed Severe negative impact (32.1% of feeling tense)	1.9 [1.6–2.3]	1.7 [1.4–2.0]	1.7 [1.4–2.0]	1.4 [1.2–1.7]	1.4 [1.2–1.6]	Ph: 1.8 [1.2–2.5]	0.99 [0.987–0.998]	0.6 [0.6–0.8]	1.2 [1.0–1.4]

Multiple logistic regression has been performed to compute odds ratios in order to identify in "feeling tense" subjects the factors the most associated with the occurrence of a "severe" intensity rated 4 or 5 (high or very high negative impact) compared to "not severe" rated 0 to 3 (no to moderate negative impact). The decision criteria was Wald Chi-square test and stepping was stopped when there were no further candidate variables that enter the model at the 5% significance level. All statistical analyses were performed at the 5% significance level.

OR = odds ratio, NS = non-significant, 95% CI = confidence interval, % = percentage. EMA: "wake up to early in the morning". Explicative variables were dichotomized as followed; the reference category being the absence of the symptom: wake-up unrested: unrested (score 5) vs. rested (scores 0–3).

Poor sleep quality: dreadful (score 5) vs. excellent (scores 0–3) except for work activities and memory capability (scores 4 or 5 vs. 0–3). Sleep dissatisfaction: dissatisfied (scores 4 or 5) vs. satisfied (scores 0–3) except for concentration (score 5 vs. scores 0–2), EMA: yes vs. no.

Frequency sleep disturbances: >3 nights vs. $\leqslant$3 nights per week. Country: Ph: Philippines; Ma: Morocco; Mx: Mexico; Pt: Portugal; Se: Sweden; Fi: Finland; and the reference category was Switzerland.

Age: increase of 1 year. Employment: unemployed vs. employed for memory capability and full time employed vs. unemployed for concentration. Noisy environment: yes vs. no.

Table 4b
Factors associated the most with severe negative impact on daytime consequences when daytime consequences for «Feeling depressed» are moderate or severe $N = 3329$ (if worker $N = 2021$).

Daytime consequences OR [95% CI]	Explicative variables								
	Wake-up unrested	Poor sleep quality	Sleep dissatisfaction	EMA insomnia symptom	>3 Nights per week	Country	Age	Employment (full time)	Noisy environment
Daily activities	2.2	1.9	2.2	1.4	1.4	Pt: 0.5 [0.3–0.7]	0.99	NS	NS
Severe negative impact (37.2% of feeling depressed)	[1.8–2.7]	[1.6–2.4]	[1.8–2.8]	[1.1–1.6]	[1.2–1.7]		[0.988–1]		
Work activities (if worker)	1.7	2.1	2.2	NS	1.7	Mx: 0.6	NS	NS	1.4
Severe negative impact (32.5% of feeling depressed)	[1.3–2.2]	[1.6–2.7]	[1.7–2.9]		[1.3–2.2]	[0.4–0.9]			[1.1–1.7]
Relationships	1.8	1.8	1.8	1.3	NS	NS	0.99	NS	NS
Severe negative impact (28.8% of feeling depressed)	[1.4–2.2]	[1.5–2.3]	[1.4–2.2]	[1.1–1.6]			[0.980–0.991]		
Leisure activities	1.9	1.6	1.8	1.4	NS	Mx: 0.7	0.99	1.4	NS
Severe negative impact (29.9% of feeling depressed)	[1.5–2.4]	[1.3–2.0]	[1.4–2.2]	[1.2–1.7]		[0.5–0.9] Pt: 0.3 [0.2–0.5] Ma: 0.6 [0.4–0.8]	[0.983–0.995]	[1.2–1.7]	
Memory capability	1.6	1.5	1.9	1.2	1.2	Lb: 1.7	1.01	NS	NS
Severe negative impact (36.5% of feeling depressed)	[1.3–2.0]	[1.2–1.8]	[1.5–2.3]	[1.0–1.4]	[1.0–1.5]	[1.1–2.8] Ph: 1.6 [1.1–2.3]	[1.004–1.015]		
Concentration	1.7	1.6	1.7	1.3	1.2	NS	NS	0.8	NS
Severe negative impact (38.0% of feeling depressed)	[1.4–2.0]	[1.3–1.9]	[1.4–2.1]	[1.1–1.5]	[1.0–1.4]			[0.7–0.9]	
Feeling tense	1.7	2.0	1.5	1.4	1.2	Pt: 0.6	0.99	NS	NS
Severe negative impact (45.4% of feeling depressed)	[1.4–2.1]	[1.6–2.4]	[1.2–1.9]	[1.2–1.6]	[1.0–1.5]	[0.4–0.9]	[0.984–0.995]		
Feel irritable	1.7	1.9	1.6	1.4	1.3	NS	0.99	NS	1.2
Severe negative impact (44.4% of feeling depressed)	[1.4–2.1]	[1.6–2.3]	[1.3–2.0]	[1.2–1.7]	[1.1–1.6]		[0.983–0.994]		[1.0–1.4]
Feel depressed	2.0	1.5	1.7	1.3	1.3	Mx: 1.4	0.99	0.7	NS
Severe negative impact (40.5% of feeling depressed)	[1.6–2.4]	[1.2–1.8]	[1.4–2.0]	[1.1–1.5]	[1.1–1.6]	[1.0–2.0] Ph: 1.5 [1.0–2.2]	[0.986–0.997]	[0.6–0.8]	

Multiple logistic regression has been performed to compute odds ratios in order to identify in "feeling depressed" subjects the factors the most associated with the occurrence of a "severe" intensity rated 4 or 5 (high or very high negative impact) compared to "not severe" rated 0–3 (no to moderate negative impact). The decision criteria was Wald Chi-square test and stepping was stopped when there were no further candidate variables that enter the model at the 5% significance level. All statistical analyses were performed at the 5% significance level.

OR = odds ratio, NS = non-significant, 95% CI = confidence interval, % = percentage. EMA: "wake up to early in the morning". Explicative variables were dichotomized as followed; the reference category being the absence of the symptom: wake-up unrested: unrested (score 5) vs. rested (scores 0–3).

Poor sleep quality: dreadful (score 5) vs. excellent (scores 0–3) except for work activities and memory capability (scores 4 or 5 vs. 0–3). Sleep dissatisfaction: dissatisfied (scores 4 or 5) vs. satisfied (scores 0–3) except for concentration (score 5 vs. scores 0–2), EMA: yes vs. no.

Frequency sleep disturbances: >3 nights vs. ⩽3 nights per week. Country: Ph: Philippines; Ma: Morocco; Mx: Mexico; Pt: Portugal; Se: Sweden; Fi: Finland; and the reference category was Switzerland. Age: increase of 1 year. Employment: unemployed vs. employed for memory capability and full time employed vs. unemployed for concentration. Noisy environment: yes vs. no.

Author's personal copy

Author's personal copy

found a greater rate of absenteeism in insomniacs compared with non-insomniacs. Finally, living in a noisy environment increased the risk of presenting more daytime impairments in work activities related to sleep disturbances. Future studies should investigate this new environmental risk factor that could be important for work productivity.

There are several limitations important to mention. The insomnia symptoms were self-reported measures assessed in a sleep questionnaire filled by a physician. It is obviously possible that people who had a poor perception of sleep may also report a poor perception of other domains of their life. But it has also been demonstrated that insomniacs had a poorer quality of life than good sleepers independently of possible physical or psychological (anxiety or depression) comorbidities.[2,29] Comorbidities were not strictly assessed in this study. In a large study in many countries, we would have to limit the number of questions to maintain good quality answers. But we had to limit the length of the questionnaire, and assessing comorbidities completely with well validated questionnaires was finally not retained. Nevertheless, we used parts of the questionnaire to try to approach as well as possible the psychiatric comorbidities and other sleep disorders which may impact daytime consequences of insomnia. Based on the doctors willing to treat, we assume that 22% of insomniacs (who would be treated by anti-depressants) had some kind of depression and 32.7% (who would be treated by anxiolytics) were anxious. These rates of comorbid psychiatric insomnia are consistent with those of the literature.[5,7,8,17,18] Similarly the percentages of insomniacs who said they have been diagnosed for sleep apnea (10%) and RLS (20%) are also consistent with previously published papers. This approach allowed us to imperfectly but sufficiently calculate the respective influence of these comorbidities on the insomniacs' symptoms. Based on univariate analysis, psychiatric items seemed to have a major impact on daytime consequences of insomnia, especially on social interaction and cognitive functioning. However, multivariate analyses found (Tables 4a and 4b) that whatever the comorbidity (sleep apnea or restless legs) or condition deduced from the questionnaire (feeling tense or depressed), the factors most closely associated with daytime consequences are sleep subjective self-assessments such as sleep quality and sleep satisfaction. The cross-sectional design of this study allows us to take a picture of a given population at a given time that should prompt further longitudinal exploration to estimate the incidence of transient and seasonal patterns of insomnia symptoms in primary care practice. Moreover, the incidence of insomnia reported here did not include the patients having pharmacological treatment in the previous 4 weeks preceeding the completion of the questionnaire. The two consecutive working days were considered non-representative of ordinary days of practice. Each physician, however, screened an average of 20 patients over these 2 days which seems to represent their average clinical activity. Moreover, we have made the choice of systematically interviewing patients on their sleep symptoms rather than taking into account only those who complain spontaneously about their sleep. We believe that this may underestimate the impact of poor sleep (subjects who did not complain spontaneously probably also did not complain of daytime consequences). But we think it would more systematically represent the consequences of poor sleep in patients visiting their GP. Indeed, insomniacs selected for this study were older (45 years old vs. 35 years old; $p < 0.001$) and were more predominantly female (65% vs. 60%) compared to non-insomniacs, which is consistent with the literature. In this study, we are also aware that some countries were much more represented than others — Finland, Morroco, Mexico — which may have influenced the global results, in which the part of Lebanon (58 patients) is very symbolic. However, these three countries were also from three very different parts of the world (North Europe, South America, and North Africa) and therefore it is not possible to deny the wealth of its multicultural assessment of insomnia. Nevertheless, we understand that variability in sample sizes across countries could induce a cultural bias in data.

5. Conclusion

In summary, insomnia complaints are frequent in primary care practices around the world. Primary insomnia disturbs subjective daytime functioning with a wide range of functioning impairments in daytime activities, cognitive, social, and emotional domains across countries. Sleep quality perception was highly associated with the occurrence of severe daytime consequences. Appropriate treatments for insomnia should be part of an educational program for health professionals in primary care practice everywhere to modify sleep quality perception of patients in order to upgrade their daytime quality of life. Future longitudinal studies are also needed to objectively assess daytime consequences (e.g., absenteeism, promotions, and divorce rate) of insomnia symptoms around the world.

6. Financial support

This survey has been supported by Sanofi-Aventis. All authors have been sponsored to design the protocol and review the data as a scientific advisory board.

Acknowledgements

Our acknowledgements to the national coordinators of each country: Prs C. Soldatos (Greece), W. Sarhan (Jordan), N. Riachi (Lebanon), H. Ouhabi (Morocco), J. Espinosa-Avila (Mexico), R. de Guzman Manalastas (Philippines), J. Maltez (Portugal) and M. Gugger (Switzerland).

References

[1] Riedel BW, Lichstein KL. Insomnia and daytime functioning. Sleep Med Rev 2000;4:277–98.
[2] Zammit GK, Weiner J, Damato N, et al. Quality of life in people with insomnia. Sleep 1999;22:S379–85.
[3] Mendelson WB, Garnett D, Gillin JC, et al. The experience of insomnia and daytime and nighttime functioning. Psychiatry Res 1984;12:235–50.
[4] Edinger JD, Fins AI, Sullivan Jr RJ, et al. Do our methods lead to insomniacs' madness?: daytime testing after laboratory and home-based polysomnographic studies. Sleep 1997;20:1127–34.
[5] Benca RM, Okawa M, Uchiyama M, et al. Sleep and mood disorders. Sleep Med Rev 1997;1:45–56.
[6] Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders: an opportunity for prevention? JAMA 1989;262:1479–84.
[7] Breslau N, Roth T, Rosenthal L, Andreski P. Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. Biol Psychiatry 1996;39:411–8.
[8] Ohayon MM. Prevalence of DSM-IV diagnostic criteria of insomnia: distinguishing between insomnia related to mental disorders from sleep disorders. J Psychiatr Res 1997;31:333–46.
[9] Hoffmann G. Evaluation of severe insomnia in the general population-implications for the management of insomnia: focus on results from Belgium. J Psychopharmacol 1999;13:S31–2.
[10] Hetta J, Broman JE, Mallon L. Evaluation of severe insomnia in the population-implications for the management of insomnia: insomnia, quality of life and healthcare consumption in Sweden. J Psychopharmacol 1999;13:S35–6.
[11] Léger D, Guilleminault C, Dreyfus JP, Delahaye C, Paillard M. Prevalence of insomnia in a survey of 12,778 adults in France. J Sleep Res 2000;9:35–42.
[12] Leger D, Guilleminault C, Bader G, Levy E, Paillard M. Medical and socio-professional impact of insomnia. Sleep 2002;25:625–9.
[13] Walsh J. Clinical and socioeconomic correlates of insomnia. J Clin Psychiatry 2004;65(Suppl. 8):13–9.
[14] Buysse DJ, Thompson W, Scott J, Franzen PL, Germain A, Hall M, et al. Daytime symptoms in primary insomnia: a prospective analysis using ecological momentary assessment. Sleep Med 2007;8:198–208.

Author's personal copy

[15] Ancoli-Israel S, Roth T. Characteristics of insomnia in the United States: results of the 1991 National Sleep Foundation Survey. Sleep 1999;22(Suppl. 2):S347–53.
[16] Soldatos C, Allaert FA, Ohta T, Dikeos DG. How do individuals sleep around the world? Results from a single-day survey in ten countries. Sleep Med 2005;6:5–13.
[17] Ohayon M, Roth T. What are the contributing factors for insomnia in the general population? J Psychosom Res 2001;51:745–55.
[18] Ohayon M. Epidemiology of insomnia: what we know and what we still need to learn. Sleep Med Rev 2002;6:97–111.
[19] National Institutes of Health State of the Science Conference Statement on Manifestations and Management of Chronic Insomnia in Adults. Sleep 2005;28:1049–57.
[20] Ancoli-Israel S. The impact and prevalence of chronic insomnia and other sleep disturbances associated with chronic illness. Am J Managed Care 2006;12:S221–9.
[21] Philips B, Hening W, Britz P, Mannino D. Prevalence and correlates of restless legs syndrome: results from the 2005 National Sleep Foundation Poll. Chest 2006;129:76–80.
[22] Roth T, Roehrs T. Insomnia: epidemiology, characteristics, and consequences. Clin Cornerstone 2003;5:5–15.
[23] Ancoli-Israel S, Roth T. Characteristics of insomnia in the United States: results of the 1991 National Sleep Foundation Survey. I. Sleep 1999;22: S347–53.
[24] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Text revision (DSM-IV-TR®). Arlington, VA: American Psychiatric Publishing; 2000.
[25] Bonnet MH, Arand DL. Hyperarousal and insomnia. Sleep Med Rev 1997;1:97–108.
[26] Lichstein KL, Wilson NM, Noe SL, Aguillard RN, Bellur SN. Daytime sleepiness in insomnia: behavioral, biological and subjective indices. Sleep 1994;17:693–702.
[27] Hoelscher TJ, Ware JC, Bond T. Initial validation of the insomnia impact scale. Sleep Res 1993;22:149.
[28] Morin CM, Stone J, Trinkle D. Dysfunctional beliefs and attitudes about sleep among older adult with and without insomnia complaints. Psychol Aging 1993;8:463–7.
[29] Léger D, Scheuermaier K, Philip P, Paillard M, Guilleminault C. SF-36: evaluation of quality of life in severe and mild insomniacs compared with good sleepers. Psychosom Med 2001;63:49–55.
[30] Klink ME, Quan SF, Kaltenborn WT, Lebowitz MD. Risk factors associated with complaints of insomnia in a general adult population. Influence of previous complaints of insomnia. Arch Intern Med 1992;152:1634–7.
[31] Alattar M, Harrington JJ, Mitchell CM, Sloane P. Sleep problems in primary care: a North Carolina family practice research network (NC-FP-RN) study. J Am Board Fam Med 2007;20:365–74.
[32] Léger D, Massuel MA, Metlaine A, SISYPHE Study Group. Professional correlates of insomnia. Sleep 2006;29:171–8.