



ELSEVIER

Sleep Medicine 4 (2003) 201–206

SLEEP
MEDICINE

www.elsevier.com/locate/sleep

Original article

The impact of somatic health problems on insomnia in middle age

Kirsti Martikainen^a, Markku Partinen^b, Joel Hasan^c, Pekka Laippala^{d,e}, Helka Urponen^f,
Ilkka Vuori^g

^aCommunity Health Centre of the City of Tampere, Hatanpääkatu 24, SF-33100 Tampere, Finland

^bHaaga Neurological Research Centre, Department of Clinical Neurosciences, University of Helsinki, Helsinki, Finland

^cDepartment of Clinical Neurophysiology, Tampere University Hospital, Tampere and Finnish Institute of Occupational Health, Neurology Division, Helsinki, Finland

^dTampere School of Public Health, University of Tampere, Tampere, Finland

^eResearch Unit, Tampere University Hospital, Tampere, Finland

^fContinuing Education Centre, University of Lapland, Rovaniemi, Finland

^gUKK Institute for Health Promotion Research, Tampere, Finland

Received 10 May 2002; received in revised form 23 August 2002; accepted 29 August 2002

Abstract

Objective: The objective of this study is to assess the impact on insomnia symptoms of somatic diseases, psychological factors, living habits and life events during the previous year.

Background: Although health problems are a significant cause of insomnia, psychosocial factors are considered to be even more important. The relative impact of these and other factors on insomnia calls for further evaluation.

Methods: A questionnaire study in a randomly selected middle-aged population in Finland ($N = 626$, 264 men and 362 women).

Results: In our study, 9.8% of men and 17.0% of women reported the occurrence of insomnia at least once a week during the previous 3 months. Insomniacs perceived their health as 'poor' or 'rather poor' more often than others and depression, allergic rhinitis, asthma, hypertension and heart symptoms such as arrhythmias were more common among them. Insomnia was not a side-effect of the treatment of these diseases; lack of medical treatment was associated with a higher incidence of insomnia. Work-related factors such as 'moving to a poorer job or to poorer working conditions' during the past year increased the possibility of insomnia, while moving house seemed to have a positive effect. When comparing these associations in logistic regression models, nervousness and tension were, however, the factors most significantly associated with insomnia.

Conclusions: Psychosocial factors appeared to be more significantly associated with prolonged insomnia than somatic health problems. © 2003 Elsevier Science B.V. All rights reserved.

Keywords: Insomnia; Somatic health; Psychosocial; Living habits; Life events

1. Introduction

Insomnia is a common symptom in many psychiatric disorders. Chronic insomnia is also considered a risk factor for the development of depression [1]. The association of physical illness and insomnia is not unexpected. In a Swedish study of men aged 30–69 years, hypertension, obstructive pulmonary disease, diabetes, obesity and rheumatic disease were found to be more prevalent among insomniacs [2]. A considerable proportion of sleep com-

plaints seems to be associated with some chronic disease, especially in elderly people with prevalent health problems and medications [3]. In comparing the prevalence of sleep complaints among patients with diabetes, recent myocardial infarction, chronic paraplegia, and musculoskeletal and affective disorders with that among healthy age-matched controls [4], the authors concluded that although many chronic illnesses may interfere with sleep, psychological and social factors seem to contribute significantly to the prediction of sleep disorders in patients with chronic illnesses. In a study by Katz and McHorney [5], many medical illnesses were associated with an increased risk of insomnia, but subjects who had depressive disorders were at greater risk of severe insomnia than those with chronic

Corresponding author. Tel.: +358-3-31473555; fax: +358-3-31473268.

E-mail address: kirsti.martikainen@tt.tampere.fi (K. Martikainen).

somatic illness. Sutton et al. studied the contribution of selective sociodemographic, lifestyle, stress, and physical health factors to the experience of insomnia [6]. A very stressful life, severe pain and dissatisfaction with one's health evinced the highest odds ratios for insomnia.

The aim of the present study was to investigate the associations of common somatic diseases and psychosocial factors with prolonged insomnia in a randomly sampled middle-aged population in Finland. Logistic regression models afforded the possibility to compare the respective impacts of these factors.

2. Methods

The study was carried out at the UKK Institute in Tampere, Finland as a part of a larger 5-year follow-up survey project called 'Sleep, sleepiness and living habits', conducted by means of mailed questionnaires. The 5-year follow-up questionnaire was mailed to those subjects who responded to the first. Of the 78 items in the follow-up questionnaire, 51 were used in the present study. The essential items of the structured questions were based on the Basic Nordic Sleep Questionnaire (BNSQ) [7], used in many other epidemiological studies in Finland and elsewhere [8–12]. Most questions concentrated on the previous 3 months. Those dealing with insomnia, sleepiness, sleep disturbances and mode of life were identical in the baseline and 5-year follow-up survey. The questions on insomnia in general and the three specific types of insomnia (difficulty initiating sleep (DIS), early morning awakenings (EMA), fragmentary sleep (FS)) all had six alternative answers. The questions were formulated as follows: Have you suffered from insomnia during the past 3 months? (insomnia in general) Have you had difficulty initiating sleep during the past 3 months? (DIS) Has your sleep been fragmentary during the past 3 months? (FS) Have you woken up too early in the morning and could not sleep again during the past 3 months? (EMA); the alternative answers were: 1. never, 2. less than once per month, 3. less than once per week, 4. 1–2 nights per week, 5. 3–5 nights per week, 6. every or almost every night. Subjects who reported having had insomnia at least one to two times a week during the past 3 months were defined as insomniacs in this study. Where not otherwise specified the term insomnia or insomniac refers to the question on insomnia in general included in this paper.

In addition to the above, the follow-up survey included questions about changes in mode of life, more detailed questions about health, medication and possible hospital treatment during the previous 5-year period and about the occurrence of 16 life events during the past year, such as 'A child is born in my family', 'I have had worries because of a family member's illness', 'A close relative or friend has died', 'I have got married', 'I have divorced or lived apart from my husband/wife as a result of a quarrel', 'I have lived apart from my husband/wife on account of work, studies or

for some other reason', 'I have moved', 'I have built a house', 'I have lost my home (e.g. by fire)', 'I have had serious financial problems', 'I have been suspected of or punished for a crime', 'I have taken a better and more responsible job', 'I have retired', 'I have become unemployed or been fired', 'There have been serious conflicts at work', 'I have moved to a poorer job or to poorer working conditions'. We inquired about hypertension and other cardio- and cerebrovascular diseases, obstructive pulmonary disease, allergic and vasomotor rhinitis, depression, epilepsy, migraine and muscle disease. The question was formulated thus: 'Have you now or have you previously had any of the following diseases? Please, also note your current medical therapy for the disease in question'. The body mass index (BMI) was computed from the self-reported values for weight and height.

Three questions referred to state of mind: 'I am usually very tense and nervous', 'In the evening I am very fatigued, both mentally and physically' and 'I have a positive attitude and I do not worry too much'. Subjects were asked whether the statement fitted well, fairly well, badly or not at all.

2.1. Subjects

The subjects in the baseline survey comprised a stratified random sample ($N = 1600$) of the adult population of the city of Tampere comprising 200 men and 200 women from each of the age groups 36-, 41-, 46- and 50-years. The questionnaire was completed by 1190 persons (549 men and 641 women), 75% of the total sample (69% of men and 81% of women).

The 1190 subjects who responded to the baseline survey were requested to participate in the 5-year follow-up study. After checking for possible new addresses, it was found that eight persons were deceased, one lived abroad, 172 could not be reached and 205 refused to participate. The questionnaire was mailed to the remaining 801 and was completed by 626 (78.2% of the 801; 264 men and 362 women), a response rate of 53% of the respondents in the original study (48% of the men and 57% of the women). The ages of the subjects at the time of the follow-up survey were 41, 46, 51 and 55 years. The respondents did not differ significantly from the non-respondents from the first survey in respect of age or prevalence of sleep disturbances. The prevalence of insomnia in the original study of 1190 subjects was 9.1% of men and 9.7% of women, while the mean age of the subjects was 43.7 years [13].

2.2. Statistical analysis

The factors associated with insomnia were studied separately by cross-tabulations and by logistic regression models. The significance of observed differences in cross-tabulations was tested by Pearson's chi-square or Fisher's exact test. After pairwise comparison, factors which differed

between insomniacs and the rest were used as categorical variables in logistic regression modelling.

In logistic regression models, the fit of the model was measured using goodness-of-fit chi-square, where a high *P*-value indicates a satisfactory fit. In the latter case the results are presented using odds ratios (OR) with 95% confidence intervals (95% CI). The model selection was carried out stepwise, where the limits for entry and removal of variables were 0.10 and 0.15, respectively (the usual default values). Computation was carried out using the BMDP Statistical Software (Version 1993) in a SUN/UNIX mainframe.

3. Results

3.1. Prevalence of insomnia

The mean age of the subjects in this study was 48.7 years (range 41–55 years). The selected cut-off point for insomnia was occurrence of symptoms at least once a week during the previous 3 months. Insomnia in general one to two times a week was found in 9.8% of men and in 17.0% of women. The number of subjects with difficulty in initiating sleep (DIS) was very similar to the number with insomnia: 9.8% of men and 17.3% of women. Both of these symptoms were more common among women and most prevalent among 55-year-olds ($P < 0.01$). The percentage of subjects who woke up too early in the morning (EMA) at least once a week was 14.9% in men and 20.9% in women; 19.1% of men and 30.1% of women reported insomnia in at least one of these questions (insomnia in general, DIS or EMA). Fragmentary sleep (FS) was a more common phenomenon: 28.6% of men and 40.6% of women reported it at least once a week, and on a daily basis it was reported by 8.4% of men and 12.1% of women. We therefore chose daily symptoms as the cut-off point in this type of insomnia. FS increased by age in both genders, becoming a daily problem for 18.8% of men and 19.0% of women at 55 years.

3.2. Mode of life among insomniacs

Marital status was not significantly different among insomniacs as compared to others. Body mass index (BMI) and exercise were on the same level in both groups. The prevalence of habitual snoring (snoring every or almost every night) did not differ significantly between insomniacs and others, nor did alcohol consumption. Insomniacs were less often current smokers than the rest (8.0% vs. 17.1%, $P = 0.032$). Insomniacs also used less coffee (mean of cups per day 4.16 vs. 4.76, $P = 0.014$). Shift-work was not more common among insomniacs, but insomniacs were less often in the labor force than the other subjects (83.9 vs. 91.7%, $P = 0.019$).

3.3. Insomnia and life events

We studied the impact of life events on insomnia by logistic regression modelling using 16 different life events (during the previous year) as categorical variables and age as an interval variable. Significant risk factors for insomnia at least once a week were ‘moved to a poorer job or to poorer working conditions’ and ‘worries because of a family member’s illness’, which correlated positively, and ‘more responsible job’ and ‘moving house’, which stood in negative correlation to insomnia (Table 1).

The same risk factors explained DIS. However, with EMA as the dependent factor only ‘worries because of a family member’s illness’ and ‘more responsible work’ were significantly associated, and with FS only retirement.

3.4. Insomnia and diseases

Subjects with insomnia had hypertension more often than others (27.9% vs. 17.9%, $P = 0.029$), especially those with DIS (29.9% vs. 17.5%, $P = 0.007$). Self-reported depression was also associated with insomnia, especially with DIS ($P < 0.001$). The association between EMA and depression was not significant. The prevalence of coronary heart disease (CHD) ($N = 11$), myocardial infarction ($N = 5$) and cerebrovascular disease ($N = 5$) was low in the whole sample and angina pectoris, myocardial or brain infarction were not significantly associated with insomnia, although other heart diseases (arrhythmias, heart failure) were reported more often among insomniacs (14.0 vs. 4.0%, $P < 0.001$). With 10.3% of the whole sample suffering from allergic rhinitis, the percentage of insomniacs with allergic rhinitis was 18.6 ($P = 0.006$). Hospital treatment among insomniacs was more common (42.5 vs. 27.1% of others, $P = 0.003$) and they perceived their health more often as ‘poor’ or ‘rather poor’ (16.1 vs. 3.2%, $P < 0.001$). The associations of different types of insomnia with diseases and hospital treatment during the previous 5 years are shown in

Table 1
Life events significantly associated with insomnia in the study population^a

Factor	OR	95% CI	<i>P</i> -value
Moved to a poorer job or to poorer working conditions	7.09	2.40–21.0	<0.001
Worries because of a family member’s illness	2.09	1.27–3.45	0.003
More responsible work	0.28	0.09–0.93	0.035
Moving house	0.35	0.10–1.21	0.092

^a OR, odds ratio; CI, confidence interval. Goodness-of-fit chi square 84.701, d.f. = 101, $P = 0.878$. Variables used in logistic regression modelling: dependent variable insomnia at least once a week, interval variable; age, categorical variables: a child is born, worries because of a family member’s illness, close relative or friend deceased, got married, divorce, live apart because of work, moving house, built a house, lost home (by fire), serious financial problems, serious conflicts at work, suspected of or punished for a crime, moved to a poorer job, loss of employment, more responsible work, retirement.

Table 2
Diseases associated with different types of insomnia in the study population^a

Term	OR (95% CI)			
	Insomnia in general OR	DIS	EMA	FS
Perceived health (poor)	4.41 (1.87–10.4)	4.41 (1.86–10.4)		3.19 (1.28–8.0)
Depression	3.39 (1.57–7.30)	3.94 (1.84–8.40)		
Arrhythmias etc.	3.76 (1.62–8.70)	2.78 (1.14–6.76)	2.84 (1.29–6.25)	2.48 (0.95–6.45)
Rhinitis	2.06 (1.10–3.85)	3.13 (1.72–5.68)	2.48 (1.45–4.26)	2.06 (1.04–4.10)
Hypertension	1.89 (1.06–3.36)	2.16 (1.21–3.86)		
Diabetes	4.74 (0.98–22.9)			
Asthma	3.08 (0.94–10.1)		2.43 (0.83–7.09)	
Myocardial infarction				6.34 (0.85–50.5)
Treatment in hospital			1.66 (1.05–2.60)	2.14 (1.19–3.83)

^a OR, odds ratio; CI, confidence interval; DIS, difficulty initiating sleep (at least once a week); EMA, early morning awakenings (at least once a week); FS, fragmentary sleep (every night). Dependent variable = Insomnia in general: Goodness-of-fit, chi-square = 93.624, df = 68, $P = 0.021$. Dependent variable = DIS: Goodness of fit chi-square = 91.647, df = 70, $P = 0.042$. Dependent variable = EMA: Goodness of fit, chi-square = 76.619, df = 71, $P = 0.303$. Dependent variable = FS. Goodness of fit chi-square = 62.675, df = 70, $P = 0.721$.

Table 2. The association between diseases and insomnia did not appear to be due to side-effects of medication. Insomnia was associated especially with non-treated diseases (Table 3). The number of patients with medication was, however, rather small.

The relative impact of somatic diseases among other risk factors associated with insomnia was studied by logistic regression models. In this connection, the only somatic problem significantly associated with insomnia was hypertension (Table 4).

4. Discussion

In the present study, we investigated the association of living habits, recent life events, psychological factors and somatic diseases with insomnia complaints. Although insomniacs seemed to drink less coffee and consume less

tobacco than other subjects, living habits were otherwise alike. Marital status was not associated with insomnia, in contrast to findings in other studies [6,14]. Even shift-work was not overrepresented among insomniacs; they were, however, less often in the labor force, as was also reported in a Canadian study by Sutton et al. [6]. Deterioration in working situation as well as worries because of a family member's illness were associated with insomnia symptoms. Positive changes in work or living conditions had a negative correlation with insomnia. The effect of low education or low income on insomnia found in the Canadian study [6] was not studied here.

Insomnia symptoms were most significantly associated with psychological symptoms such as nervousness and tension, as already known from many previous studies. In generalized anxiety disorder the typical sleep disturbance is sleep-maintenance insomnia and to a lesser degree sleep-onset insomnia [15]. Depression in the present

Table 3
Diseases with and without treatment as risk factors of insomnia^a

Disease	N (%)	
	Insomniacs	Others
Allergic rhinitis		
No medication	13 (15.1)*	32 (6.2)
Medication	3 (3.5)	14 (2.7)
Hypertension		
No medication	6 (7.0)	37 (7.0)
Medication	18 (20.9)	57 (10.8)
Depression		
No medication	12 (14.0)***	22 (4.2)
Medication	4 (4.7)***	6 (1.1)
Other heart disease		
No medication	9 (10.5)***	13 (2.5)
Medication	3 (3.5)	8 (1.5)

^a * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 4
The most significant risk factors associated with insomnia^a

Factor	Insomnia OR (95% CI)	Significance, P value
Nervousness and tension	3.05 (1.66–5.63)	<0.001
Poorer job	6.10 (1.82–20.5)	0.001
Fatigue	2.24 (1.22–4.12)	0.001
Moving house	0.19 (0.04–0.83)	0.003
Depression	2.78 (1.22–6.33)	0.023
Hypertension	2.05 (1.10–3.82)	0.026
Short sleep (<6.5 h)	2.70 (1.19–6.15)	0.034
More responsible work	0.32 (0.09–1.11)	0.059
Family member's illness	1.70 (0.96–3.00)	0.069

^a OR, odds ratio; CI, confidence interval; Dependent variable = Insomnia: Goodness of fit, chi-square = 251.981, df = 276, $P = 0.847$. Categorical variables: perceived health (poor), depression, nervousness and tension, other heart disease (except angina pectoris), rhinitis (allergic or vasomotor), epilepsy, hypertension, fatigue, gender (female), short sleep (<6.5 h), age (≥ 55 years), work (daytime, shift-work, not at work), moved to a poorer job or to poorer working conditions, worries because of a family member's illness, more responsible work, removal.

study was especially associated with DIS but not with EMA. Older depressed patients typically have early morning awakening, while younger depressed patients complain of difficulty in falling asleep [16].

Which particular diseases are most prominently associated with insomnia in epidemiological studies depends, for example, on the age of the study population and the methods used. In the present middle-aged study population, some diseases occurred rarely and others were not investigated in the questionnaire. CHD was rare, especially among the middle-aged women here, and was not associated with insomnia, as were hypertension and other heart problems such as arrhythmias. Allergic rhinitis and asthma were associated with insomnia, as was also found in a multicentre study in Iceland, Sweden and Belgium [17].

All diagnoses were based on the subjects' own reports. The reliability of the self-reported diagnoses is evidently higher if the medication used is in accordance with the reported disease. It is, however, possible to have a disease without continuous treatment, as is often the case with seasonal allergic symptoms. Since it is possible that the association between disease and sleep disturbance or daytime sleepiness derives from pharmacological therapy, information on the medication used is important for the interpretation of any associations found. The hypothesis that medication constitutes a cause of insomnia symptoms is not supported by the present findings, since untreated subjects seemed to have insomnia more often than those who were medicated. The former may, however, have had causes for insomnia other than lack of treatment (e.g. financial problems). A higher level of health-care consumption among subjects with severe insomnia has also been found in a European multinational survey [18]. In the present study, patients with insomnia needed hospital treatment more often during the previous 5 years than better sleepers. Insomniacs also more often perceived their health as 'poor' or 'rather poor' than did others.

Even more than depression or somatic health problems, nervousness and tension were most commonly associated with insomnia. This study could provide no answer to the question of whether nervousness and tension were the causes or consequences of insomnia. All diseases with symptoms occurring during the night or in supine position may interfere with sleep. When considering treatment for insomnia, proper evaluation of somatic health is important. Although general practitioners may have many other possibilities to improve their patients' sleep, hypnotics are too often the only treatment prescribed. It is obvious that proper treatment of allergic disease such as rhinitis, asthma or eczema, as well as reflux esophagitis, angina pectoris and rheumatic pain is essential for good sleep. It was impossible to demonstrate the possible causal relationship between the somatic diseases and insomnia symptoms because exact information concerning the diseases was requested only in the follow-up survey. It is more likely that e.g. allergic

rhinitis causes insomnia than vice versa, but the association of insomnia with hypertension and arrhythmias is less clear. It has been theorized that insomnia symptoms might be part of a larger syndrome, which includes poor health and depression. Insomnia has also been related to autonomic dysfunction, which increases the risk of heart problems [19].

In many cases there is more than one reason for insomnia. We studied a middle-aged population, comparing the association of life-events, work situations, psychosocial aspects and somatic health problems with insomnia symptoms. Studies in a younger or older population, and with a different array of factors, might give somewhat different results. According to this as well as other studies, it may be concluded that adequate treatment of the somatic disease is important in preventing insomnia, but in prolonged cases a concomitant psychiatric disorder, most often depression or anxiety disorder, should also be considered.

Acknowledgements

This study was supported by the Yrjö Jahnsson Foundation and the Medical Research Fund of Tampere University Hospital.

References

- [1] Lustberg L, Reynolds CF. Depression and insomnia: question of cause and effect. *Sleep Med Rev* 2000;4:253–62.
- [2] Gislason T, Almqvist M. Somatic diseases and sleep complaints. An epidemiological study of 3201 Swedish men. *Acta Med Scand* 1987; 221:475–81.
- [3] Foley DJ, Monjan AA, Brown SL, et al. Sleep complaints among elderly persons: an epidemiologic study of three communities. *Sleep* 1995;18:425–32.
- [4] Hyypää M, Kronholm E. Quality of sleep and chronic illness. *J Clin Epidemiol* 1989;42:633–8.
- [5] Katz DA, McHorney CA. Clinical correlates of insomnia in patients with chronic illness. *Arch Intern Med* 1998;158:1099–107.
- [6] Sutton DA, Moldofsky H, Badley EM. Insomnia and health problems in Canadians. *Sleep* 2001;24:665–70.
- [7] Partinen M, Gislason T. Basic Nordic Sleep Questionnaire (BNSQ): a quantitated measure of subjective sleep complaints. *J Sleep Res* 1995; 4(Suppl. 1):150–5.
- [8] Gislason T, Benediktsdóttir B, Björnsson JK, et al. Snoring, hypertension and the sleep apnoea syndrome. An epidemiological survey of middle-aged women. *Chest* 1993;103:1147–51.
- [9] Martikainen K, Urponen H, Partinen M, et al. Day time sleepiness: a risk factor in community life. *Acta Neurol Scand* 1992;86:337–41.
- [10] Palomäki H. Snoring and the risk of ischemic brain infarction. *Stroke* 1991;22:1021–5.
- [11] Partinen M. Sleeping habits and sleep disorders before and after military service (in Finnish). *Acta Milit Fenn* 1982;57(Suppl. 1): 1–96.
- [12] Smirne S, Palazzi S, Zucconi M, et al. Habitual snoring as a risk factor for acute vascular disease. *Eur Respir J* 1993;6:1357–61.
- [13] Martikainen K, Partinen M, Hasan J, et al. The problem of long-term insomnia: a 5-year follow-up study in a middle-aged population. *Sleep Hypnosis* 2001;3:97–105.

- [14] Ohayon M. Epidemiological study on insomnia in the general population. *Sleep* 1996;19(3 Suppl):S7–S15.
- [15] Monti J, Monti D. Sleep disturbance in generalized anxiety disorder and its treatment. *Sleep Med Rev* 2000;4:263–76.
- [16] Prinz PN, Vitello MV, Raskind MA, Thorpy MJ. Geriatrics: sleep disorders and aging. *N Engl J Med* 1990;323:520–6.
- [17] Janson C, De Backer W, Gislason T, et al. Increased prevalence of sleep disturbance and daytime sleepiness in subjects with bronchial asthma: a population study of young adults in three European countries. *Eur Respir J* 1996;9:2132–8.
- [18] Chevalier H, Los F, Boichut D, et al. Evaluation of severe insomnia in the general population: results of a European multinational survey. *J Psychopharmacol* 1999;13(4 Suppl 1):S21–4.
- [19] Schwartz S, McDowell-Anderson W, Cole SR, et al. Insomnia and heart disease: a review of epidemiologic studies. *J Psychosom Res* 1999;47:313–33.