

## Gender and Sleep Disturbance

# Sleep Disturbances in a Young Adult Population: Can Gender Differences Be Explained by Differences in Psychological Status?

\*Eva Lindberg, \*Christer Janson, †Thorarinn Gislason, \*Eythor Björnsson,  
‡Jerker Hetta and \*Gunnar Boman

\*Department of Lung Medicine and Asthma Research Centre, Uppsala University, Akademiska sjukhuset, Uppsala, Sweden;

†Department of Lung Medicine, Vífilsstaðir Hospital, Gardabær, Iceland; and

‡Sleep Disorder Unit, Department of Psychiatry, Uppsala University, Akademiska sjukhuset, Uppsala, Sweden

**Summary:** To study the prevalence of reported sleep disturbances and the association between these complaints and psychological status, 529 randomly selected subjects aged 20–45 years were questioned about their sleep symptoms and psychological status by means of questionnaires.

In this young population, feeling refreshed in the morning almost every day was reported by only 15.3%. Females reported a significantly longer mean total sleep time (TST) than males (F:  $425 \pm 58$  minutes, M:  $403 \pm 50$  minutes;  $p < 0.01$ ). Despite this, the difference compared with the reported need of sleep was greater in females ( $56 \pm 62$  minutes) than in males ( $40 \pm 51$  minutes) ( $p < 0.05$ ). Difficulties maintaining sleep (DMS,  $\geq 3$ /week) (F: 20.1%, M: 10.4%;  $p < 0.01$ ), the absence of feeling refreshed in the morning (F: 36.2%, M: 26.8%;  $p < 0.05$ ), and excessive daytime sleepiness (EDS) (F: 23.3%, M: 15.9%;  $p < 0.05$ ) were significantly more common among females. According to the Hospital Anxiety and Depression scale, females suffered from anxiety more frequently than males (F: 32.8%, M: 18.9%;  $p < 0.001$ ). An association was found between anxiety and many sleep disturbances. After making adjustments for age, smoking, snoring, gender and psychological status by means of multiple regression, the gender differences mentioned above remained significant. We conclude that despite a longer TST, females report insufficient sleep, EDS, DMS, and the absence of feeling refreshed in the morning more frequently than males. The higher prevalence of anxiety among females alone cannot explain the gender differences in sleep disturbances seen in this population. **Key Words:** Insomnia—Gender—Anxiety—Epidemiology—Daytime sleepiness.

Poor sleep is a frequently reported complaint (1,2) and is often a chronic health problem (3,4). Many cross-sectional studies have demonstrated that the prevalence of self-reported sleep disturbances is age and sex dependent, with a higher prevalence among females (1–9). A general survey conducted in 1979 in the U.S.A. indicated that 35% of all adults experienced insomnia during that year, half of them reporting it as a serious problem (2). The complaints were more frequent in older women who displayed high levels of psychic distress, somatic anxiety, and depressive symptoms. In a survey of 1,006 households in the Los Angeles metropolitan area, Bixler et al. (7) found that

the prevalence of sleep disorders increased with age and was, again, highest among females. In the populations investigated by Quera-Salva et al. (9) and Lugaresi et al. (1), a marked gender difference was also seen after age 45.

A relationship between anxiety, depression, and insomnia has been indicated by the data from many clinical studies (1,3,9–12). Among patients with rheumatoid arthritis, Nicassio and Wallston (10) stated that sleep problems, but not pain, have a highly significant effect on residualized depression. Various abnormalities of sleep architecture have also been related to different psychiatric disorders when studied by polygraphic sleep recordings (13,14).

In a Finnish epidemiologic survey in 1985, Urponen et al. (15) investigated self-evaluations of factors disturbing sleep. They found a statistically significant dif-

Accepted for publication March 1997.

Address correspondence and reprint requests to Eva Lindberg, Department of Lung Medicine, Akademiska sjukhuset, S-751 85, Uppsala, Sweden.

ference between women and men; women perceived psychological factors as the most important causes of impeding sleep. Men, on the other hand, ranked work-related causes as most important, while psychological factors came third.

In an international survey, we have previously found that nocturnal awakenings and total sleep time are related to the female gender (16). The aim of this investigation was to study these gender differences in more detail and to investigate whether this was due to differences in the psychological status of females and males.

## METHODS

### Population

In the European Commission Respiratory Health Survey, a random sample of 3,600 men and women aged 20–45 was selected using the population register in Uppsala (17). A postal questionnaire was sent to all subjects, to which there was a response rate of 87%. From those who replied during this initial phase, a random selection of 705 persons was invited to participate in the second phase of the study, which included a structured interview and examination. The number of participants in this second phase was 623 (88%).

### Sleep questionnaire

After completing the interview and examination, all subjects were asked to fill in a separate questionnaire relating to the quality of sleep and sleep-related symptoms. The questionnaire was a slightly modified version of a questionnaire used in previous Swedish and Icelandic studies (18–20). It included four questions with answers expressed as continuous variables, where the subjects were asked to estimate the average time it took them to fall asleep in the evening, total sleep time, the average number of nocturnal awakenings, and their estimated need of sleep (expressed as hours/night). Fourteen multiple-choice questions dealt with sleep disturbance and daytime symptoms, mainly those associated with insomnia, with the answers expressed as discontinuous variables on a nominal scale. For the multiple-choice questions, the subjects were asked to estimate the frequency of different symptoms on a five-point scale, the same as in the Basic Nordic Sleep Questionnaire (21): 1) never, 2) less than once a week, 3) one to two nights a week, 4) three to five nights a week, and 5) almost every night. Sleep sufficiency was measured by the sleep sufficiency index (SSI), that is, the ratio of amount of reported total sleep time to the estimated need for sleep expressed

as a percentage (22). The number of subjects who completed the sleep questionnaire was 542 (87%).

### Psychological status

In addition to the sleep questionnaire, all subjects were asked to fill in the self-reported Hospital Anxiety and Depression Scale (HAD) questionnaire (23). This questionnaire has been extensively used for screening psychiatric morbidity (24–27) and has a high validity when used as a screening instrument for psychiatric morbidity in outpatients (26). It consists of 14 questions; seven questions are related to anxiety and seven to depression. Each item (for example, "I can laugh and see the funny side of things") is rated on a four-point scale [e.g. as much as I always do (0), not quite so much (1), definitely not so much (2), and not at all (3)] giving maximum subscale scores of 21 for depression and anxiety, respectively. Zigmond and Snaith (1983) recommended that scores of eight or more on a subscale should be taken as an indication of possible pathology (23). This cut-off point was thus used for classifying clinical anxiety and depression, respectively. The number of individuals who filled in the HAD questionnaire correctly was 529 (75%); all of those had also completed the sleep questionnaire (24). The data from these 529 persons were used for this further analysis.

The informed consent of all participants was obtained, and the study was approved by the Ethics Committee of the Medical Faculty at Uppsala University.

### Statistical methods

The statistical analysis was performed on a Macintosh IIfx computer using the Statistica 4.0 software package (StatSoft Inc., Tulsa, OK). The results are presented as the means  $\pm$  standard deviation (SD). A chi-square test was used for a comparison of proportions. When the comparison involved continuous variables, the Mann–Whitney *U* test was used, while the Spearman rank correlation test was used for comparison of an ordinal scale (HAD scale). A simple linear regression was used to calculate correlations between continuous variables. For the simultaneous evaluation of more than two factors, a multiple logistic regression analysis or a multiple linear regression was performed. The minimum statistical significance level for all analyses was  $p < 0.05$ .

## RESULTS

The mean age of the 529 subjects who completed the interview, the sleep questionnaire, and the HAD

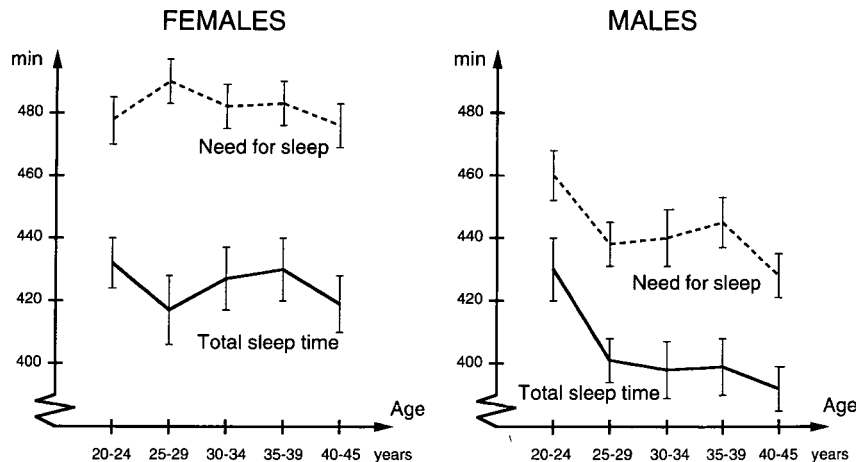


FIG. 1. Total sleep time and need for sleep among females and males. Mean  $\pm$  standard error of the mean (SEM).

questionnaire was  $32.4 \pm 7.4$  years, and 51% were women. Current smoking was reported by 24% of the subjects. The responders did not differ from the non-responders in age, gender, or smoking habits (24).

There were no significant gender or age differences when it came to the prevalence of current smoking. Snoring was reported by 15.3% of the smokers compared with 8.4% of the nonsmokers ( $p < 0.05$ ). Among the ex-smokers, no significantly increased prevalence of snoring was found.

### Sleeping habits

The mean reported total sleep time and the need for sleep among females and males at different ages are presented in Fig. 1. In the whole group, the mean total sleep time was  $425 \pm 58$  minutes for females and  $403 \pm 50$  minutes for males ( $p < 0.01$ ). The mean difference between the reported need for sleep and total sleep time (Alack of sleepA) was  $56 \pm 62$  minutes for females and  $40 \pm 51$  minutes for males ( $p < 0.05$ ).

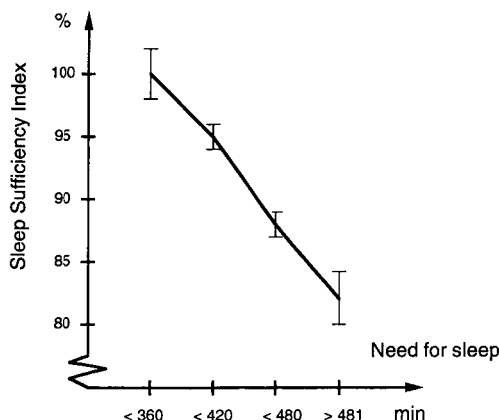


FIG. 2. Sleep sufficiency index (the ratio of total sleep time to need for sleep) by reported need for sleep.

Sleep sufficiency index was somewhat lower in females than in males ( $88.9 \pm 12.1$  vs.  $91.5 \pm 11.0\%$ ,  $p < 0.05$ ). There was a strong negative correlation between the reported need for sleep and SSI ( $r = -0.42$ ,  $p < 0.001$ ) (Fig. 2). Furthermore, SSI correlated negatively to both the anxiety score ( $r = -0.20$ ,  $p < 0.001$ ) and the depression score ( $r = -0.18$ ,  $p < 0.01$ ) on the HAD scale.

A decrease in total sleep time was seen with increasing age ( $r = -0.13$ ,  $p < 0.05$ ), and the estimated need for sleep also decreased somewhat with age ( $r = -0.11$ ,  $p < 0.05$ ). The numbers of awakenings/night showed a small but statistically significant female predominance (F:  $1.2 \pm 1.2$ , M:  $1.0 \pm 1.1$ ;  $p < 0.05$ ). In an univariate analysis, no significant gender difference was seen in reported sleep latency (F:  $16 \pm 27$  minutes, M:  $18 \pm 22$  minutes). After making adjustments for anxiety, however, increased sleep latency was related to the male gender ( $r = 0.09$ ,  $p < 0.05$ ).

### Sleep complaints and gender differences

In the whole group, the most frequent sleep disturbance was the difficulty of maintaining sleep (DMS), reported by 15.5%. Difficulties inducing sleep (DIS) three or more nights/week were reported by 5.5% of the subjects and early morning awakenings (EMA) by 5.0%. Feeling refreshed in the morning almost every day was reported by 15.3%, while feeling refreshed in the morning less often than once a week was reported by 31.8%.

In Table 1, the prevalence of sleep disturbances among females and males is presented. Difficulty maintaining sleep was found to be significantly more common among females. Excessive daytime sleepiness (EDS) and the absence of feeling refreshed in the

**TABLE 1.** Prevalence of sleep disturbances, daytime symptoms, anxiety, and depression among females and males (%)

Symptom	Females	Males	p values
DIS, $\geq 3$ /week	4.8	5.6	ns
DMS, $\geq 3$ /week	20.1	10.4	$p < 0.01$
EMA, $\geq 3$ /week	5.6	4.4	ns
EDS, $\geq 3$ /week	23.3	15.9	$p < 0.05$
Snoring, $\geq 3$ /week	4.5	16.0	$p < 0.001$
Nightmares, $\geq 1$ /week	4.8	2.8	ns
Feeling refreshed in the morning, $< 1$ /week	36.2	26.8	$p < 0.05$
Anxiety	32.8	18.9	$p < 0.001$
Depression	4.4	8.3	ns

DIS, difficulty inducing sleep; DMS, difficulty maintaining sleep; EMA, early morning awakening; EDS, excessive daytime sleepiness.

morning were also significantly related to the female gender.

Age was found to associate negatively with EDS ( $p < 0.01$ ) and positively with snoring ( $p < 0.05$ ). In the case of the other sleep complaints, no relationship to age could be identified.

### Psychological status

According to the preceding criteria for anxiety and depression, 139 subjects (26.3%) had a score on the HAD scale that indicated anxiety, and 33 (6.2%) had a score that indicated depression. There was a significant association between anxiety and depression, since 22 individuals reported both ( $p < 0.001$ ). As can be seen in Table 1, anxiety was significantly more frequent in females. Depression tended to be more common in males, but the difference was not significant ( $p = 0.07$ ).

In the whole group, a significant positive association was found between anxiety and DIS ( $p < 0.05$ ), DMS ( $p < 0.001$ ), EMA ( $p < 0.01$ ), daytime sleepiness ( $p$

$< 0.001$ ), and nightmares ( $p < 0.01$ ). After eliminating the effect of depression, the relationship between anxiety and EMA disappeared and the relationship between anxiety and DIS was no longer significant ( $p = 0.06$ ), while all the other differences remained statistically significant. When females and males were analyzed separately, the associations mentioned above were seen in both genders, even though the significant levels varied. In males, anxiety was also associated with snoring (Table 2).

Anxiety was further related to increased sleep latency ( $p < 0.001$ ), number of awakenings/night ( $p < 0.001$ ), and need for sleep ( $p < 0.01$ ). When analyzing these relationships separately by gender, the association between anxiety and reported need for sleep was significant only among males. The increased sleep latency and number of awakenings/night were related to anxiety in both genders. Furthermore, a longer total sleep time was reported by males with anxiety (Table 3).

In the whole group, a significant positive association was found between depression and DIS ( $p < 0.01$ ), EMA ( $p < 0.001$ ), daytime sleepiness ( $p < 0.001$ ), and the absence of feeling refreshed in the morning ( $p < 0.05$ ). Among females, depression was also associated with an increased prevalence of DMS  $\geq 3$ /week, while depression was found to be related to nightmares in males (Table 2).

### Multiple regression

To analyze the independent predictors of sleep disturbances, logistic regressions were performed with age, gender, anxiety, depression, current smoking, and snoring as independent variables. To minimize the effects of interactions, the products of gender \* anxiety and gender \* depression were also included as independent variables in all logistic regressions. In this

**TABLE 2.** Prevalence of sleep disturbances and daytime symptoms among subjects with and without anxiety and depression (%). The data are presented for females and males separately

Symptom	Females <sup>ab</sup>		Males		Females		Males	
	Anxiety:		Anxiety:		Depression:		Depression:	
	No (183)	Yes (91)	No (207)	Yes (48)	No (262)	Yes (12)	No (234)	Yes (21)
DIS, $\geq 3$ /week	3.3	8.9*	4.8	10.6	4.6	18.2*	4.7	20.0**
DMS, $\geq 3$ /week	14.8	31.5**	9.3	14.9	19.2	45.4*	10.3	10.5
EMA, $\geq 3$ /week	3.3	10.0*	3.4	8.7	4.6	27.3**	3.0	20.0***
EDS, $\geq 3$ /week	15.5	40.9***	12.2	31.9***	22.8	50.0*	12.1	60.0***
Snoring, $\geq 3$ /week	3.9	5.6	13.7	26.1*	4.3	9.1	15.2	25.0
Nightmare, $\geq 1$ /week	3.3	7.8	1.5	8.5*	4.6	9.1	2.2	10.0*
Feeling well-rested in the morning, $< 1$ /week	34.8	40.0	25.5	31.9	35.8	54.6	24.7	50.0*

For abbreviations, see Table 1.

<sup>a</sup> Number of subjects in parentheses.

<sup>b</sup> \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ . Significance levels calculated for differences within gender.

**TABLE 3.** *Sleeping habits among subjects with and without anxiety and depression. Mean values ( $\pm$ SD) are presented for females and males separately*

	Females <sup>ab</sup>		Males	
	Anxiety:		Anxiety:	
	No (183)	Yes (91)	No (207)	Yes (48)
Sleep latency (minutes)	12 $\pm$ 11	23 $\pm$ 23***	17 $\pm$ 21	24 $\pm$ 25***
Total sleep time (minutes)	429 $\pm$ 54	416 $\pm$ 65	400 $\pm$ 49	413 $\pm$ 55***
Need for sleep (minutes)	479 $\pm$ 47	486 $\pm$ 42	438 $\pm$ 48	447 $\pm$ 57***
Number of awakenings/night	1.1 $\pm$ 1.2	1.5 $\pm$ 1.2**	0.9 $\pm$ 1.0	1.3 $\pm$ 1.2**
	Females		Males	
	Depression:		Depression:	
	No (262)	Yes (12)	No (234)	Yes (21)
Sleep latency (minutes)	15 $\pm$ 15	29 $\pm$ 35**	18 $\pm$ 22	22 $\pm$ 24
Total sleep time (minutes)	424 $\pm$ 59	426 $\pm$ 60	403 $\pm$ 50	401 $\pm$ 48
Need for sleep (minutes)	482 $\pm$ 46	473 $\pm$ 20	439 $\pm$ 49	458 $\pm$ 53
Number of awakenings/night	1.2 $\pm$ 1.2	1.2 $\pm$ 1.4	0.9 $\pm$ 1.1	1.3 $\pm$ 1.0

<sup>a</sup> Number of subjects in parentheses.

<sup>b</sup> \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ . Significance levels calculated for differences within gender.

model, female gender turned out to be an independent predictor of EDS and unrefreshing sleep. A score on the HAD scale that indicated depression was independently related to EMA, not feeling refreshed in the morning, and EDS (Table 4). Also, DIS  $\geq 3$ /week, DMS  $\geq 3$ /week, and nightmares  $\geq 1$ /week were analyzed with this model, but none of the independent variables associated significantly with any of these sleep disturbances. There was a tendency toward association between female gender and DMS  $\geq 3$ /week [odds ratio (OR) 1.8, 95% confidence interval (CI)

0.9–3.4;  $p = 0.08$ ]. With DMS almost every night as the dependent variable, female gender was the only independent predictor with an adjusted OR of 2.5 (95% CI 1.01–6.2;  $p < 0.05$ ).

Female gender was further significantly related to a longer total sleep time ( $r = 0.20$ ,  $p < 0.001$ ) and need for sleep ( $r = 0.39$ ,  $p < 0.001$ ) as well as an increased number of awakenings/night ( $r = 0.09$ ,  $p < 0.05$ ) even after adjustments for age, anxiety, depression, smoking, and snoring. On the other hand, male gender was related to a longer reported sleep-onset latency ( $r = 0.09$ ,  $p < 0.05$ ). Anxiety was related to a longer sleep-onset latency ( $r = 0.22$ ,  $p < 0.001$ ) and to an increasing number of awakenings/night ( $r = 0.14$ ,  $p < 0.001$ ), independently of the other variables.

**TABLE 4.** *Variables related to sleep disturbances and daytime symptoms*

Dependent variable	Independent variable <sup>a</sup>	OR	95% CI <sup>b</sup>
Excessive daytime sleepiness, $\geq 3$ /week	Depression	10.1	3.5–29.6***
	Snoring	3.3	1.7–6.3***
	Female	1.9	1.01–3.6*
	Age(–) <sup>c</sup>	0.6	0.4–0.8***
Feeling refreshed in the morning, $< 1$ /week	Depression	2.9	1.1–7.8*
	Female	1.8	1.1–2.8*
Early morning awakenings, $\geq 3$ /week	Depression	6.7	1.6–28.8**
Snoring, $\geq 3$ /week	Male	3.8	1.6–9.2**
	Smoking	2.2	1.2–4.1*
	Age <sup>d</sup>	1.6	1.1–2.4*

OR, odds ratio; CI, confidence interval.

<sup>a</sup> The independent variables examined are age, gender, anxiety, depression, smoking, and snoring using multiple logistic regressions. The products of gender\*anxiety and gender\*depression are included in all logistic regressions to minimize the effects of interactions. The variables are ranked in order of their influence. The result is presented as an adjusted OR with a 95% CI.

<sup>b</sup> \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

<sup>c</sup> (–) = negative correlation.

<sup>d</sup> OR calculated for a 10-year increase in age.

## DISCUSSION

The results of our study indicate that poor sleep and lack of sleep are associated with the female gender even in a young adult population. The second main finding in this investigation is that, despite an association between psychological status and sleep complaints, the higher prevalence of anxiety among females cannot per se explain the gender differences relating to insomnia.

A female predominance of sleeping complaints has been found in many previous epidemiologic surveys (1–9). This gender difference has, however, generally been most pronounced in older age groups. In the San Marino population (1), no significant differences in the prevalence of insomnia were found until the age of 44. These different results might, however, be attributable

to different methods used to evaluate insomnia and not to differences between the samples.

In addition to female gender, increasing age has been found by many authors to be the second main variable correlating to poor sleep (1–9). In our young population, however, age was found to influence the prevalence of sleep disturbances to a very limited degree. In a healthy population, aged 50–65, carefully screened for physical health, Bliwise et al. (28) found a very low prevalence of poor sleep. In this paper, the authors argued that the correlation between age and sleep disturbances found in other surveys might be due to the influence of other age-related diseases or chronic health conditions that are related to poor sleep. Gislason and Almqvist (18) also found that the increase in certain sleep complaints with age related to the reporting of somatic diseases. Due to the low age of our population, there is, however, reason to assume that the vast majority of subjects in our study are healthy and that the prevalence of chronic diseases is low. This may explain why age was found to relate only to snoring and to no other sleeping complaints except for a negative relationship to daytime sleepiness.

The low age of our population could also explain the overall relatively low prevalence of reported sleep disturbances and the low use of hypnotic drugs. With this background, it is surprising that no more than 15.3% reported feeling refreshed almost every morning. This means that, despite a relatively low prevalence of sleep disturbances, 84.7% of this young population feels tired at least one morning a week.

When the self-reported sleeping time for men and women was compared, a highly significant difference was found. On average, women normally slept 22 minutes longer each night. This is in accordance with data found by Bliwise et al. (28) and by Broman et al. (22). However, despite the longer sleeping time, women suffered from a higher degree of lack of sleep than men. The mean difference between the reported need for sleep and total sleep time among females was 56 minutes compared to 40 minutes for males ( $p < 0.05$ ). When defining insomnia as the chronic inability to obtain the amount of sleep that a person needs for optimal functioning and well-being (29), it seems clear from the data obtained that females constitute a risk group. Due to the higher degree of lack of sleep, it is not surprising that the prevalence of daytime sleepiness and the absence of feeling refreshed in the morning are significantly higher among females. In addition to the lack of sleep, females also reported more awakenings/night. The subjects in this survey were all in the child-bearing age group (20–45 years). One reason why females suffered from more awakenings/night might be that they are more often woken by small children. A correlation between female gender and

nocturnal awakenings has, however, also been seen in more elderly populations (6,8,30), indicating that awakenings due to children are not the only explanation.

Females were found to suffer from a significantly higher prevalence of anxiety compared with males. The higher prevalence of women reporting anxiety is in accordance with other reports [for instance, Mellinger et al., who reported that individuals with serious insomnia were women with high levels of psychic distress and anxiety (2)]. This association between psychological distress and insomnia has also been found by others (1,3,9–12). The higher prevalence of anxiety among females would therefore appear to be a conceivable explanation for the gender differences in sleep complaints. After performing multiple logistic regression, however, all gender differences remained independent of anxiety; this hypothesis was therefore rejected.

An association between insomnia and a depressed mood has been found in several epidemiological studies (28,31,32). Being a core symptom of major depression, insomnia may be considered to be secondary to the depressive state. However, Ford and Kamerow found in their prospective study that insomnia may be an early sign or even the cause of depression (32). Recently, one epidemiological study reported that a dysphoric mood was a major consequence of insufficient sleep (22). Zammit also found in an experimental study that poor sleep resulted in complaints of dysphoria (33). Furthermore, a high rate of mood disturbance has been seen among patients with other disorders affecting the quality of sleep, such as the sleep apnea syndrome (34,35). Mosko et al. found significant improvement in mood disturbance after treatment of the sleeping disorder, indicating that the high level of psychological distress is a consequence rather than a cause of the disorder (34). Similarly, the possibility cannot be excluded that the higher rate of anxiety found in females is also a consequence of the higher rate of insomnia.

Sleeping habits and sleeping complaints were investigated in this study with a questionnaire. One disadvantage of this method is the fact that the results are partly dependent on the subject's subjective assessment of his/her own symptoms. Using objective methods of measurement such as the EEG, some investigations have demonstrated a discrepancy between subjective and objective assessments of sleep disturbance (36). The reliability of our data would obviously be affected if the tendency to overestimate sleep disturbances was influenced by gender. As far as we know, however, there is as yet no objective evidence to support such an argument.

We conclude that despite longer total sleep time,

even in a young adult population, females suffer from a higher degree of insomnia. The association between anxiety and female gender found in this study does not explain the gender differences relating to sleeping habits, the need for sleep, and sleep complaints. More research is still required to obtain an understanding of insomnia and the cause of those gender differences.

**Acknowledgements:** This study was supported financially by the Swedish Heart and Lung Foundation, the Swedish Medical Research Council, the Swedish Association against Asthma and Allergy, the Herman Krefting Foundation, the Bror Hjerpstedt Foundation, and the County Council of Uppsala. We wish to thank Signe Svedberg-Brandt, R.N., and Elisabeth Rydehn, R.N., for their skillful work with the patients and Maria Medén for her excellent secretarial assistance.

## REFERENCES

1. Lugaresi E, Cirignotta F, Zucconi M, Mondini S, Lenzi PL, Coccagna G. Good and poor sleepers: an epidemiological survey of the San Marino population. In: Guilleminault C, Lugaresi E, eds. *Sleep/wake disorders: natural history, epidemiology, and long-term evolution*. New York: Raven Press, 1983:1-12.
2. Mellinger GD, Balter MB, Uhlenhuth EH. Insomnia and its treatment. Prevalence and correlates. *Arch Gen Psychiatr* 1985;42:225-32.
3. Hohagen F, Rink K, Kappler C, et al. Prevalence and treatment of insomnia in general practice. A longitudinal study. *Eur Arch Psych Clin Neurosci* 1993;242:329-36.
4. 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 Int Med* 1992;152:1634-7.
5. Karacan I, Thornby JI, Anch M, et al. Prevalence of sleep disturbance in a primarily urban Florida county. *Soc Sci Med* 1976;10:239-44.
6. McGhie A, Russell SM. The subjective assessment of normal sleep patterns. *J Mental Sci* 1962;108:642.
7. Bixler EO, Kales A, Soldatos CR, Kales JD, Healy S. Prevalence of sleep disorders in the Los Angeles metropolitan area. *Am J Psych* 1979;136:1257-63.
8. Reyner A, Horne JA. Gender- and age-related differences in sleep determined by home-recorded sleep logs and actimetry from 400 adults. *Sleep* 1995;18:127-34.
9. Quera-Salva MA, Orluc A, Goldenberg F, Guilleminault C. Insomnia and use of hypnotics: study of a French population. *Sleep* 1991;14:386-91.
10. Niccasio PM, Wallston KA. Longitudinal relationships among pain, sleep problems, and depression in rheumatoid arthritis. *J Abnorm Psychol* 1992;101:514-20.
11. Hirshkowitz M, Hamilton CR III, Rando KC, Bellamy M, Williams RL, Karacan I. State-trait anxiety scores in adults with sleep complaints. *Sleep Res* 1990;19:163.
12. Paulsen VM, Shaver JL. Stress, support, psychological states and sleep. *Soc Sci Med* 1991;32:1237-43.
13. Lund HG, Bech P, Eplov L, Jennum P, Wildschijdtz G. An epidemiological study of REM latency and psychiatric disorders. *J Affect Disord* 1991;23:107-12.
14. Reynolds CF III, Shaw DH, Newton TF, Coble PA, Kupfer DJ. EEG sleep in outpatients with generalised anxiety: a preliminary comparison with depressed outpatients. *Psychiatr Res* 1983;8: 81-9.
15. Urponen H, Vuori I, Hasan J, Partinen M. Self-evaluations of factors promoting and disturbing sleep: an epidemiological survey in Finland. *Soc Sci Med* 1988;26:443-50.
16. Janson C, Gislason T, De Backer W, et al. Prevalence of sleep disturbances among young adults in three European countries. *Sleep* 1995;18:589-97.
17. Burney PGJ, Luczynska CM, Chinn S, Jarvis D. The European Community Respiratory Health Survey. *Eur Respir J* 1994;7: 954-60.
18. Gislason T, Almqvist M. Somatic diseases and sleep complaints. *Acta Med Scand* 1987;222:475-81.
19. Janson C, Gislason T, Boman G, Hetta J, Roos B-E. Sleep disturbances in patients with asthma. *Respir Med* 1990;84:37-42.
20. Gislason T, Reynisdottir H, Kristbjarnarson H, Benediksdottir B. Sleep habits and sleep disturbances among the elderly—an epidemiological survey. *J Int Med* 1993;234:31-9.
21. Partinen M, Gislason T. Basic Nordic Sleep Questionnaire (BNSQ): a quantitated measure of subjective sleep complaints. *J Sleep Res* 1995;4Suppl 1:150-5.
22. Broman J-E, Lundh L-G, Hetta J. Insufficient sleep in the general population. *Neurophysiol Clin* 1996;26:30-9.
23. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand* 1983;67:361-70.
24. Janson C, Björnsson E, Hetta J, Boman G. Anxiety and depression in relation to respiratory symptoms and asthma. *Am J Respir Crit Care Med* 1994;149:930-4.
25. Lewin B, Robertson IH, Cay EL, Irving JB, Campbell M. Effects of self-help post-myocardial infarction rehabilitation on psychological adjustment and use of health services. *Lancet* 1992;339:1036-40.
26. Moorey S, Greer S, Watson M, et al. The factor structure and factor stability of the Hospital Anxiety and Depression Scale in patients with cancer. *Br J Psychiatr* 1991;158:255-9.
27. Wilkinson MJB, Barczak P. Psychiatric screening in general practice: comparison of the general health questionnaire and the hospital anxiety and depression scale. *J R Coll Gen Pract* 1988;38:311-3.
28. Bliwise DL, King AC, Harris RB, Haskell WL. Prevalence of self-reported sleep in a healthy population aged 50-65. *Soc Sci Med* 1992;34:49-55.
29. Hauri PJ, Esther MS. Insomnia (review). *Mayo Clin Proc* 1990;65:869-82.
30. Liljeborg B, Almqvist M, Hetta J, Roos B-E, Agren H. Age and the prevalence of insomnia in adulthood. *Eur J Psychiatr* 1989;3:5-12.
31. Liljeborg B, Almqvist M, Hetta J, Roos BE, Agren H. Affective disturbance and insomnia: a population study. *Eur J Psychiatry* 1989;3:91-8.
32. Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *J Am Med Assoc* 1989;262:1479-84.
33. Zammit G. Subjective ratings of the characteristics and sequelae of good and poor sleep. *J Clin Psychol* 1988;44:123-30.
34. Mosko S, Zetin M, Glen S, et al. Self-reported depressive symptomatology, mood ratings and treatment outcome in sleep disorders patients. *J Clin Psychol* 1989;45:51-60.
35. Klonoff H, Fleetham J, Taylor R, Clark C. Treatment outcome of obstructive sleep apnea: physiological and neuropsychological concomitants. *J Nerv Ment Dis* 1987;175:208-12.
36. Carskadon MA, Dement WC, Mitler MM, Guilleminault C, Zarcone VP, Spiegel R. Self-reports versus sleep laboratory findings in 122 drug-free subjects with complaints of chronic insomnia. *Am J Psychiatr* 1976;133:1382-8.