

# Insomnia in Men—A 10-Year Prospective Population Based Study

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**Study objectives:** to prospectively analyze changes in the prevalence of insomnia and the relationship between insomnia, aging, lifestyle, and medical disorders

**Design:** a longitudinal population survey.

**Participants:** a randomly selected population sample of 2,602 men (age 30-69 years) from Uppsala in Sweden.

**Intervention:** all participants answered a questionnaire on sleep disturbances, lifestyle factors, and medical disorders in 1984 and again in 1994.

**Measurements and Results:** The prevalence of INSOMNIA was 10.3% in 1984 and 12.8% in 1994. No significant correlation was found between age and insomnia in any of the two time periods. Insomnia in 1994 was independently related to having insomnia in 1984 (OR=6.45), being overweight (BMI > 27 kg/m<sup>2</sup>) (OR=1.35), physical inactivity (OR=1.42), alcohol dependence (OR=1.75), psychiatric disorders (OR=8.27) and joint/low

back disorders (OR=2.95). The number of subject with reported insomnia in 1984 but not 1994 was 149. Subjects that quit smoking during the time period had an increased likeliness of remission (OR=2.70) while men who were overweight were less likely to remit (OR=0.43).

**Conclusions:** We conclude that in men insomnia is related to lifestyle factors such as obesity, physical inactivity and alcohol dependency but not to aging. Medical disorders such as joint and low back disorders and psychiatric illnesses also increase the risk of reporting insomnia. This study demonstrates the close relationship between quality of sleep and overall health status.

**Key words:** Insomnia; alcohol dependence; physical activity; obesity; medical disorders

## INTRODUCTION

INSOMNIA IS A COMMON CONDITION<sup>1-3</sup> WHICH SEVERELY AFFECTS AN INDIVIDUAL'S QUALITY OF LIFE.<sup>4</sup> Insomnia has been found to be related to both somatic and psychiatric disorders<sup>1,5-8</sup> as well as life style factors such as overuse of alcohol and smoking.<sup>2,9,10</sup> Several investigations have found that the prevalence of insomnia and other sleep disturbances increases with age,<sup>5,11,12</sup> while other studies have not found the prevalence of insomnia to be age-related.<sup>3,7,13</sup>

In 1984 a random population sample of middle-aged men from Uppsala in Sweden were invited to participate in an epidemiological survey.<sup>1,14,15</sup> The main purposes of the survey were to estimate the prevalence of the obstructive sleep apnea syndrome<sup>15</sup> and to study the relationship between sleep disturbances and medical disorders.<sup>1,14</sup> In 1994 this population was reinvestigated which so far has enabled us to prospectively investigate the medical consequences of habitual snoring and daytime sleepiness.<sup>16,17</sup>

The aim of this study was to prospectively analyze changes in the prevalence of reported insomnia and the relationship between insomnia and aging, lifestyle, and medical disorders.

## METHODS

### Population

In 1984, a sample of 4021 men aged 30 to 69 years was randomly selected from the population registry for the city of

Uppsala in Sweden.<sup>1,14,15</sup> A postal questionnaire was sent to all subjects and the response rate was 79.6% (n=3201). In November 1994, all the survivors among the subjects who replied in 1984 (n=2975) were invited to take part in the follow-up by answering a new postal questionnaire (16,17). The number of subjects who participated in the follow-up was 2668 (89.7%).

### Questionnaires

The questionnaire used in 1984 consisted of 24 questions including questions about sleep disturbances, medical disorders, height, and weight.<sup>1,14</sup> The questions about sleep related to the participants present situation (in the last months). The participants were to assess the severity of various sleep disturbances using a five-point scale: ranging from 1:(none) to 5: (very severe). The questionnaire used in 1994 consisted of 64 questions.<sup>16,17</sup> The first 24 questions were identical to those used in 1984. In the second part, 40 new questions were added, including questions about current and past smoking habits, alcohol use and physical activity.

### Definitions

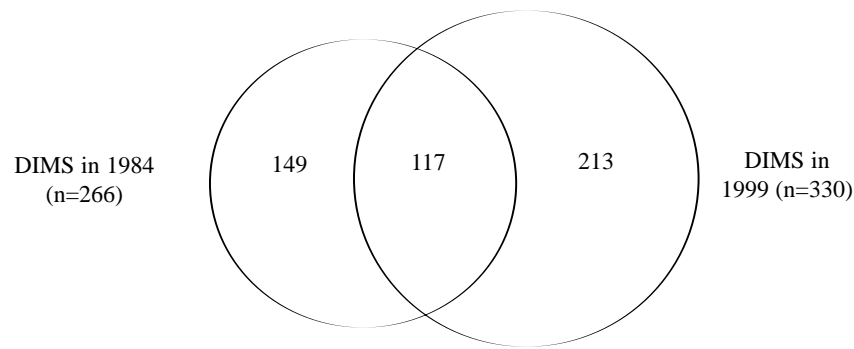
Subjects who scored 4 and 5 ("severe" and "very severe") on the questions of difficulties falling asleep and/or difficulties maintaining sleep were regarded as having insomnia.

Obesity was assessed by calculating body mass index (weight/(height)<sup>2</sup>). Subjects with a BMI > 27 kg/m<sup>2</sup> were defined as being overweight.<sup>16</sup> Change in BMI was calculated as BMI 1994 - BMI 1984.

Smoking habits were assessed by six questions 1994.<sup>16</sup> The subjects were asked if they had ever smoked regularly for at least six months and if they were current smokers or ex-smokers. Those who had smoked at one time were also asked at what age

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**Figure 1**—Relationship between reported insomnia in 1984 and 1994. The figure indicates the number of subjects divided according to overlap or no overlap in reported insomnia in the two time-points.

they had started smoking and when they had quit. As no one in this population had started smoking during the 10-year period, smoking habits were categorized in three groups: (a) non-smoker at baseline and at the follow up; (b) smoker at baseline and non-smoker at the follow up; (c) smoker both at baseline and the follow up.

Alcohol dependence was investigated using the questions from the CAGE questionnaire, which have been found to be highly sensitive and specific for the recognition of alcohol dependence.<sup>18</sup> The subjects who answered “yes” to at least two of the four questions were defined as being alcohol dependent.

In the questions related to physical activity, four different categories with an increasing level of physical activity during leisure time was presented.<sup>19-21</sup> Physical inactivity was defined as category 1 (i.e., spending most time in front of the television, reading and other sedentary activities). This questionnaire was developed in the late 1960s and has been validated against maximal oxygen uptake in male athletes.<sup>19</sup> The physical activity indicators in the questionnaire have also been found to correlate to mortality in a population study in women.<sup>21</sup>

Subjects who reported regular medical check ups because of a disease were defined as having a medical disorder. The diseases reported were then categorized in the following disorders: hypertension, ischemic heart disease (angina pectoris and myocardial infarction), obstructive lung disease (asthma, chronic bronchitis, and chronic obstructive pulmonary disease), diabetes, gastritis, or peptic ulcer disease, joint or low back disorders, psychiatric disorders and other.

## Statistics

The method proposed by Gardner and Altman was used when estimating change in correlated proportions, such as the prevalence of insomnia in 1984 and 1994 (22). Chi2-test and Mann-Whitney U test was used when comparing subject with and without insomnia in the univariate analysis. To study the influence of several possible explanatory variables on insomnia, multiple logistic regression was performed and the adjusted odd ratios (OR) with 95% confidence interval calculated. The statistical software package StatView 5.0 (SAS Institute Inc, Cary, NC, USA) was used for all calculations.

## RESULTS

### Non-responders

The prevalence of insomnia in 1984 was significantly higher in those subject who subsequently died during the 10 year follow-up period than in subjects who were still alive (22.5 vs. 11.1%,  $p<0.001$ ). Among the survivors, non-responders had a higher prevalence of insomnia in 1984 than in responders (15.9 vs. 10.3%,  $p<0.01$ ). The non-responders were also slightly younger (53.7 (11.6) vs. 55.1 (11.1) years,  $p<0.01$ ) (mean (SD)) but did not differ significantly in terms of mean BMI compared to responders.

### Sleep Disturbances

The number of subjects who answered both questions related to insomnia in 1984 and 1994 was 2602. In 1994 145 subjects (5.4%) reported severe problems with difficulties inducing sleep and 246 (9.3%) reported severe problems with difficulty maintaining sleep. The prevalence of insomnia was 10.3% in 1984 and 12.8% in 1994. Of the 330 subjects that fulfilled the criteria for insomnia in 1994, 213 did not have insomnia 1984. The number of subjects that reported insomnia in 1984 but not in 1994 was 149 (Fig 1).

When analyzing the prevalence of insomnia in 1984 and 1994 by age a significant increase of insomnia was only found in the youngest age group (Table 1). No significant relationship was found between age and the prevalence of insomnia in 1984 or 1994.

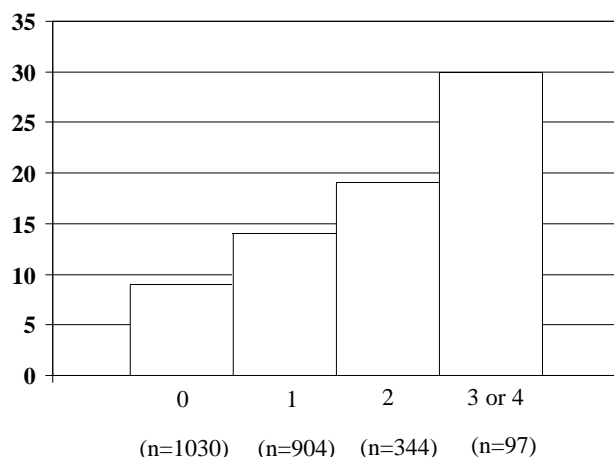
**Table 1**—Prevalence and changes in prevalence of insomnia 1984 and 1994 (%). Change is presented as mean values and 95% confidence interval.

Age 1984	1984	1994	Change
30-39	10.1	13.9	3.8 (1.5 , 6.1)
40-49	10.4	12.7	2.4 (-0.3, 5.1)
50-59	9.2	10.1	0.9 (-2.2, 3.9)
60-69	11.5	12.3	0.8 (-3.3, 4.9)

**Table 2**—Body mass index, smoking history, physical inactivity, and alcohol dependence in subjects with and without insomnia 1994 (mean (SD) and %). (\*= $p<0.05$ , \*\*= $p<0.01$ , \*\*\*= $p<0.001$ ).

	No insomnia	Insomnia
BMI 94 (kg/m <sup>2</sup> )	25.3 (3.0)	25.7 (3.7)*
BMI > 27 kg/m <sup>2</sup>	29.2	39.8***
Change in BMI (kg/m <sup>2</sup> )	0.9 (1.9)	1.2 (2.1)*
No smoking 84 or 94	67.6	58.3**
Quit smoking after 84	10.3	11.7
Smoker 84 and 94	22.1	30.0**
Physically inactive 94	14.4	24.0***
Alcohol dependent 94	8.6	18.9***

DIMS (%)



**Figure 2**—Prevalence of reported insomnia in relation to the number of lifestyle risk factors in 1994. The risk factors in this figure is smoking, being overweight (BMI > 27 kg/m<sup>2</sup>), physical inactivity and alcohol dependence.

**Table 3**—Medical reasons for regular examinations in 1984 and 1994 (n [%]).

	1984	1994
Hypertension	168 (6.3)	252 (9.4)
Ischemic heart disease	29 (1.1)	82 (3.1)
Obstructive lung disease	43 (1.6)	58 (2.2)
Diabetes	32 (1.2)	86 (3.2)
Gastritis/peptic ulcers	39 (1.4)	35 (1.3)
Joint/low back disorder	102 (3.8)	104 (3.9)
Psychiatric problems	36 (1.3)	32 (1.2)
All disease	660 (24.7)	881 (33.0)

**Table 4**—Prevalence and changes in prevalence of insomnia 1984 and 1994 (%) in relation to medical status. Change is presented as mean values and 95% confidence interval.

	1984	1994	Change
No medical disorder	6.5	8.8	2.3 (0.7, 3.9)
Disorder 84 but not 94	17.3	17.8	0.5 (-5.2, 6.2)
Disorder 94 but not 84	11.5	18.8	7.2 (3.2, 11.3)
Disorder 84 and 94	19.2	18.2	-0.9 (-5.3, 3.5)

## Lifestyle Factors

Subjects who reported insomnia in 1994 had a higher BMI, a higher increase in BMI during the 10-year period, were more often smokers, more often physically inactive and had also more often symptoms of alcohol dependence than subjects not reporting insomnia in 1994 (Table 2). The number of negative lifestyle indicators was calculated for each individual in order to investigate the combined effect of smoking, being overweight, physical inactivity, and alcohol dependence. The prevalence of insomnia was found to increase with the number of lifestyle risk factors (Fig 2). There was no significant difference between the age groups in the proportion of subjects who had stopped smoking during the 10-year period.

## Medical Disorders

The number of men who reported having a medical disorder was 630 (24.2%) in 1984 and 859 (33.0%) in 1994. The prevalence of different medical disorders is reported in Table 3.

Of those reporting a medical disorder in 1994, 433 had done so also in 1984 while 426 had not. The number of men who reported a medical disorder in 1984 but not 1994 was 197. A significant increase in insomnia was found in the group of subjects who reported a medical disorder in 1994 but not 1984. No significant change in insomnia was found in the group with medical disorders in both 1984 and 1994 or in the group with medical disorders only in 1984 (Table 4). The age group of subjects who in 1984 were less than 40 years old had a significantly lower prevalence of new medical disorders than the older age groups (11.6 vs. 18.9%,  $p<0.001$ ).

A significantly higher prevalence of insomnia in 1994 was found in subjects with hypertension, diabetes, gastritis/peptic ulcers, joint/low back disorders and psychiatric disorders in 1994 (Figure 2). The relationship between insomnia and obstructive lung disease was of borderline significance ( $p=0.05$ ).

## The Healthy Male

The prevalence of insomnia in men who had not reported any medical disorder or negative lifestyle factor in 1984 or in 1994 ( $n=676$ ) was 4.9% in 1984 and 6.8% in 1994. This change in the prevalence of insomnia was not statistically significant (95% CI = -0.2, 4.3)%. No significant relationship was found between age and insomnia in 1984 or in 1994 in this group of healthy men.

## Multivariate Analysis

When risk factors for insomnia 1994 were analyzed by logistic regression insomnia in 1984, having medical disorders, being over weight, being physical inactive and having symptoms of alcohol dependence were significant risk factors for reporting insomnia in 1994 (Table 5). A significant association between BMI and insomnia 1994 was found (OR = 1.06 (1.01-1.10)) when BMI was expressed as a continuous variable instead of as binary variable.

The combined effect of smoking, obesity, physical inactivity, and alcohol dependence was studied by comparing the risk of insomnia in subjects without negative lifestyle factors against groups of subjects with increasing numbers of negative lifestyle indicators. In this model adjustment was made for insomnia in

**Table 5**—Independent risk factors for having insomnia 1994. Multiple logistic regression was performed with adjustment for all the independent variables in the table.

	Odds ratio	95% confidence interval
Insomnia 84	6.45	4.74-8.79
Age 1994 40-49	1	
Age 50-59	0.80	0.58-1.10
Age 60-69	0.61	0.40-0.93
Age 70-79	0.69	0.44-1.09
No medical disorder 84 or 94	1	
Disorder 84 but not 94	1.68	1.04-2.70
Disorder 94 but not 84	2.15	1.52-3.03
Disorder 84 and 94	1.94	1.34-2.83
BMI >27 kg/m <sup>2</sup> 94	1.35	1.01-1.81
Change in BMI 84-94	1.01	0.94-1.08
No smoking 84 or 94	1	
Quite smoking after 84	1.02	0.66-1.58
Smoker 84 and 94	1.26	0.92-1.71
Physically inactive 94	1.43	1.03-1.97
Alcohol dependent 94	1.75	1.20-2.54

1984, medical disorders 1984 and 1994 and age. The odds ratio (95% CI) for insomnia in 1994 was 1.45 (1.07-1.97) for individuals with one risk factor 1.96 (1.35-2.86) for subjects with two and 3.06 (1.73-5.46) for subjects with three or four indicators of a negative lifestyle.

In order to analyze the effect of specific medical disorders on insomnia, a new model was created by entering all the different medical disorders reported in 1994. A significant relation to insomnia was found for joint/low back disorders (OR = 2.95 (1.76-4.93)) and for psychiatric disorders (OR = 8.27 (3.35-20.45)) ( $p < 0.001$ ). A borderline correlation between insomnia and gastric/peptic ulcer disorder was found (OR = 2.36 (0.92-6.03) ( $p = 0.07$ )). No significant correlation was found between insomnia and hypertension, ischemic heart disease, obstructive

**Table 6**—Characteristics of subjects with and without remission of insomnia (n=266) (mean (SD) and %) (\*\* =  $p < 0.01$ )

	Remission (n=149)	No remission (n=117)
Age	46 (12)	44 (11)
BMI 94 (kg/m <sup>2</sup> )	25.3 (3.5)	26.5 (4.0)**
BMI > 27 kg/m <sup>2</sup>	30	47**
Change in BMI (kg/m <sup>2</sup> )	1.1 (3.5)	1.2 (2.1)
No smoking 84 or 94	55	57
Quite smoking after 84	16	6*
Smoker 84 and 94	29	37
Physically inactive 94	16	26
Alcohol dependent 94	18	23
No medical disorder	40	34
Disorder 84 but not 94	11	16
Disorder 94 but not 84	16	21
Disorder 84 and 94	33	29

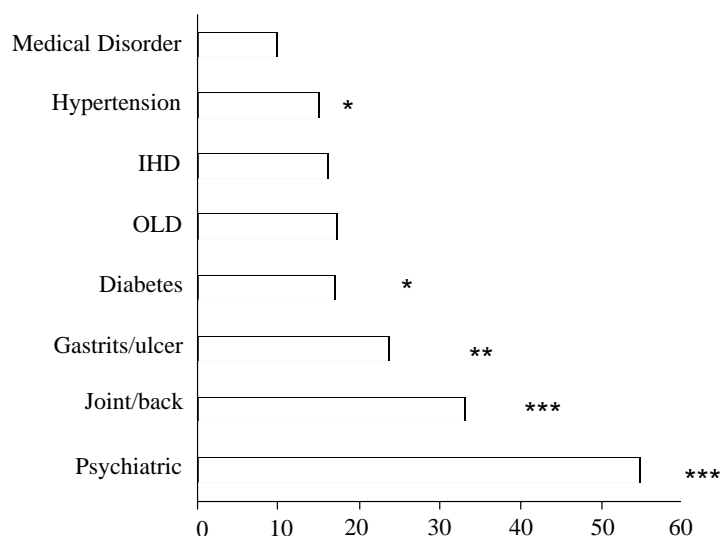
lung disease, or diabetes.

## Remission

Subjects with insomnia 1984 who did not have insomnia 1994 had a significantly lower BMI 1994 and were more likely to have quit smoking during the 10-year period (Table 6). These correlations remained significant after adjusting for age, smoking, physical inactivity, alcohol dependence, and medical disorders. The odds ratios (95% confidence interval) for having a remission for subjects with a BMI > 27 kg/m<sup>2</sup> and subjects who quit smoking were 0.43 (0.23-0.78) and 2.70 (1.20-8.33), respectively.

## DISCUSSION

The main finding of this longitudinal study is that in men insomnia is related to both lifestyle factors and medical health. Our study does not, however, give any clear indication that aging in it self increases the risk of insomnia.



**Figure 3**—Prevalence of insomnia in relation to reported medical disorders in 1994. (IHD = ischemic heart disease, OLD = obstructive lung disease) (\* =  $p < 0.05$ , \*\* =  $p < 0.01$ , \*\*\* =  $p < 0.001$ , compared to subjects with no medical disorder)

The number of subjects that reported insomnia had increased somewhat compared to the prevalence 10 years earlier, but this increase was limited to the youngest age group (30–40 years 1984). The reason why the prevalence of insomnia increased in the youngest age group is unknown to us since this age group had a lower prevalence of new medical disorders and did not differ in change of smoking habits compared to the older age groups. As we found no significant cross-sectional correlation between age and insomnia in any of the two time periods our results does not support that insomnia is related to aging.

The present study found that the risk of having insomnia was higher in subjects who were obese, were physically inactive and had symptoms related to alcohol dependence. A higher prevalence of insomnia in physically inactive subjects has been found in several other population studies.<sup>6,10,23</sup> A relation between overuse of alcohol and insomnia has been reported from two previous cross sectional studies.<sup>9,10</sup> This relationship might, however to some extent be related to the fact that some subjects with insomnia use alcohol in order to improve sleep.<sup>24</sup> Obesity has generally more often been related to other kinds of sleep disturbances like habitual snoring and the obstructive sleep apnea syndrome<sup>25,26</sup> than insomnia. Smoking, obesity, physical inactivity, and alcohol dependence are all markers of an unhealthy lifestyle. In our analysis three of these four indicators of unhealthy living were independently related to insomnia. The prevalence of insomnia increased with the number of negative lifestyle factors.

Several previous studies have shown that patients with chronic disorders as asthma,<sup>27</sup> diabetes<sup>1,28</sup> and cardiovascular disease<sup>1,29</sup> have an increased prevalence of insomnia. An increased prevalence of insomnia in subjects with chronic health problems has been a constant finding in previous population studies.<sup>1,5-8,12,13</sup> In the present study subjects who reported a medical disorder in 1994 but had not done so 1984 had the highest incidence of insomnia. Subjects with psychiatric disorders and joint and low back problems had the largest risk of insomnia. The association between psychiatric disorders and insomnia is well known<sup>6,7,13,30</sup> and there has even been indications that insomnia in it self may be a risk factor for psychiatric disorders such as depressions.<sup>31-34</sup> The association between insomnia and low back/joint disorders is probably caused by problems with pain during the night.

In our population approximately one fourth of the men had no life style risk factor and had not reported any medical disorder in 1984 and 1994. In this group of healthy men the prevalence of insomnia was about half of that found in the general population. Our result is in this aspect in accordance with Bliwise and co-workers who found a low prevalence of sleep disturbances when investigating a population sample of healthy men.<sup>35</sup>

The fact that insomnia is related to both an unhealthy life style and to medical disorders also probably explains why the prevalence of insomnia in 1984 was twice as high in subjects who died during the follow-up period than in the subjects who were still alive in 1994.

Of the 266 subjects who had insomnia in 1984 a little over half did not report insomnia in 1994. Men with a high body mass were less likely to have a remission, while men that had stopped smoking were more likely not to report insomnia 10 years later. A higher prevalence of insomnia in smokers than non-smokers have been reported in some studies.<sup>2,36</sup> Our study indicates that improved quality of sleep is one of many positive effects of

smoking cessation.

This study has a fairly long follow up time and high response rate. There are, however, several potential problems that should be taken into account when interpreting our results. The main problem is that all data on health status was self reported and not crosschecked with medical records. Our definition of medical disorders may also have left out some subjects who had more mild diseases that did not require regular medical check ups. In some ways the study was not entirely prospective as data on physical activity and alcohol dependence was only collected in the 1994 survey. The questions related to insomnia and medical health status were, however, identical in the two questionnaires. The reason why only men were studied in this investigation was that the population was primarily chosen to estimate the prevalence of the obstructive sleep apnea syndrome. This was done in 1984 when the obstructive sleep apnea syndrome was considered to be a mainly male disorder.

We conclude that in men insomnia is related to lifestyle factors such as obesity, physical inactivity, and alcohol dependency but not to aging. Medical disorders such as joint and low back disorders and psychiatric illnesses also increase the risk of having insomnia. This study clearly demonstrates the close relationship between quality of sleep and over all health status.

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