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Original Article

Snoring men with daytime sleepiness drive more than others: A population-based study

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ABSTRACT

Objective: To investigate whether subjects with daytime sleepiness who snore or report witnessed sleep apneas drive more than others.
Methods: Questions on snoring, witnessed sleep apnea, excessive daytime sleepiness and driving distance per year were included in the Northern Sweden component of the WHO, MONICA study. Invited were 10756 subjects aged 25–79 years, randomly selected from the population register.
Results: There were 7905 (73%) subjects, 3858 men and 4047 women who responded to the questionnaire and attended a visit for a physical examination. Habitually snoring men with daytime sleepiness drove a mean of 22566 (95% CI 18550–26582) km a year, which was significantly more than non-snoring men without excessive daytime sleepiness who drove 17751 (95% CI 17076–18427) km a year, $p = 0.02$, after adjustments for age, body mass index, smoking and physical activity. Men reporting witnessed sleep apnea and excessive daytime sleepiness also drove more than their counterparts in adjusted analysis, $p = 0.01$. Women reporting daytime sleepiness and witnessed apnea tended to drive more, while snoring women with daytime sleepiness did not.
Conclusions: Men suffering from excessive daytime sleepiness who snore habitually or report witnessed sleep apneas drive significantly more than others.

1. Introduction

Motor vehicle accidents are a leading cause of death and severe injuries worldwide. Many accidents, especially single-vehicle accidents, are associated with sleepiness and falling asleep while driving [1,2]. Obstructive sleep apnea is a prevalent disorder related to age, obesity and male gender. Snoring and excessive daytime sleepiness are the most common symptoms of sleep apnea. The treatment of obstructive sleep apnea using continuous positive airway pressure reduces daytime sleepiness, improves driving performance and reduces the risk of motor vehicle accidents [3–6].

It is against the law in many countries, including Sweden, to drive when experiencing daytime sleepiness and snoring or obstructive sleep apnea, unless treated successfully [7]. Both obstructive sleep apnea and snoring have been recognized as strong risk factors for traffic accidents. Case-control studies report that subjects with obstructive sleep apnea run a 3- to 10-fold higher risk of traffic accidents [8–10]. Moreover, snoring men without sleep apnea run a more than 3-fold higher risk of traffic accidents, which is of the same magnitude as men with sleep apnea [11]. A recent study from Argentina also reports similar results among snoring truck drivers [12].

No previous study was found that systematically explored the driving distance among subjects with daytime sleepiness, snoring or sleep apnea, despite the fact that these subjects are recognized risks in traffic. We aimed to investigate whether subjects with daytime sleepiness who snore or report witnessed sleep apneas drive more than others.

2. Methods

Questions on sleep-disordered breathing were included in the northern Sweden component of the WHO "Multinational monitoring of trends and determinants in cardiovascular disease" (MONICA) study in 1999 and 2004 [13]. Participants were randomly selected from the population register in the two northernmost counties of Sweden and stratified for age into 10-year groups, between 25 and 79 years of age. A total of 10756 men and women were invited to participate, 8256 in 1999 and 2500 in 2004. The participants were given questionnaires and were invited for physical examinations.

The ethics committee at Umeå University approved the study protocol and all the subjects gave their informed consent.

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2.1. Questionnaire and definitions

The questions "Do you snore while asleep?", "Do you suffer from excessive sleepiness during the daytime?" and "Has your partner noticed that you have apneas during sleep?" were assessed according to "Yes, always," "Yes, often," "Yes, sometimes," "No, almost never," "No, never" or "I don't know." Habitual snoring was considered if snoring frequency was rated as "Yes, always" or "Yes, often." Excessive daytime sleepiness was considered when scoring "Yes, always" or "Yes, often." Witnessed apnea was considered at a reported frequency of "Yes, always," "Yes, often" or "Yes, sometimes."

Physical activity during leisure time was estimated according to: "Non-active": A short walk once in a while or no activity at all; "Active": gentle or more active physical activity for at least 2 h a week, such as bicycling, dancing, tennis, badminton and so on; "Very active" strenuous training at least 3 h a week, including running, tennis, swimming, aerobics, football and so on.

The subjects were asked how many kilometers they had driven during the last year and whether or not they were daily smokers.

2.2. Physical examinations

Height, weight and waist circumference were measured in each participant in a standing position during normal breathing. Body mass index was calculated in kg/m^2.

2.3. Statistics

The results are presented as the mean (95% confidence interval) for yearly driving distances and as proportions for categorical variables. A two-sided *t*-test was used to analyze whether mean levels differed between groups of subjects, while a Pearson χ^2-test was used to analyze differences in proportions. The association between excessive daytime sleepiness and snoring or witnessed apneas and driving distance was analyzed by univariate linear regression and multiple linear regression, adjusting for age, body mass index, physical activity and smoking. Subjects with missing values were excluded from the analysis (Table 1). The outcome is reported by the β-coefficient together with 95% confidence intervals and *p*-values. A *p*-value of <0.05 was regarded as significant. For categorical variables, β is an estimate of the difference in driving distance compared with a reference category. Men and women were analyzed separately. SPSS version 15.0 was used for the statistical analysis.

Table 1
Characteristics of the study population.

	Number (%)	Missing data on driving distance Number (%)
Men	3858 (48.8%)	36 (0.9)
Women	4047 (51.2%)	171 (4.2)
Age (years)		
25–44	2230 (28.2)	85 (3.8)
45–54	1793 (22.7)	37 (2.1)
55–64	1865 (23.6)	42 (2.3)
65–74	1778 (22.5)	37 (2.1)
>75	239 (3.0)	6 (2.5)
Excessive daytime sleepiness		
No	6863 (86.8)	157 (2.3)
Yes	969 (12.3)	28 (2.9)
Missing data	73 (0.9)	22 (30.1)
Snoring		
No	6432 (81.4)	171 (2.7)
Yes	1448 (18.3)	21 (1.5)
Missing data	25 (0.3)	15 (60)
Witnessed sleep apnea		
No	6393 (80.9)	162 (2.5)
Yes	997 (12.6)	8 (0.8)
Missing data	515 (6.5)	37 (7.2)

3. Results

Of 10756 subjects, 7905 (3858 men and 4047 women) (73%) answered the questionnaires and attended visits for physical examinations. The number of missing answers in the questionnaires was low. The characteristics of the study population and the number of subjects with missing data are presented in Table 1. Men snored habitually more frequently than women (25.8% vs. 14.1%, respectively, $p < 0.001$), they reported witnessed sleep apneas more frequently (21.0% vs. 6.2%, respectively, $p < 0.001$) and drove more than women (18130 km vs. 6420 km a year, respectively, $p < 0.001$). Men accounted for 73.6% of the total car driving distance. Women reported excessive daytime sleepiness more frequently than men (14.5% vs. 10.1%, respectively, $p < 0.001$).

3.1. Men

Habitually snoring and excessive daytime sleepiness was reported by 4.7% of men. These men drove a mean of 22566 (95% CI 18550–26582) km a year, which was significantly more than non-snoring men without excessive daytime sleepiness, who drove 17751 (95% CI 17076–18427) km year, $p < 0.001$ (Fig. 1). This difference also remained significant, $p = 0.02$ in multiple analysis with adjustments for age, body mass index, physical activity and smoking habits (Table 2). Witnessed sleep apneas and excessive daytime sleepiness was reported by 4.3% of men. These men drove a mean of 23424 (95% CI 19203–25645) km a year, which was significantly more than non-sleepy men without witnessed apnea who drove 18205 (95% CI 17477–18933) km a year, $p < 0.001$ (Fig. 2). This difference also remained significant, $p = 0.01$, in multiple analysis with adjustments for age, body mass index, physical activity and smoking habits (Table 3).

Men aged 25–54 years old drove significantly more than older men (Table 2). In addition, overweight and obese men with a body mass index over 25 kg/m^2 drove more than slim men. Physical activity and smoking did not affect the driving distance.

Of men, 5.7% reported excessive daytime sleepiness and habitual snoring or witnessed apnea, and they drove 7.1% of the total distance driven by men. Of the total distance driven by men, 10.6% was driven by drivers reporting excessive daytime sleepiness.

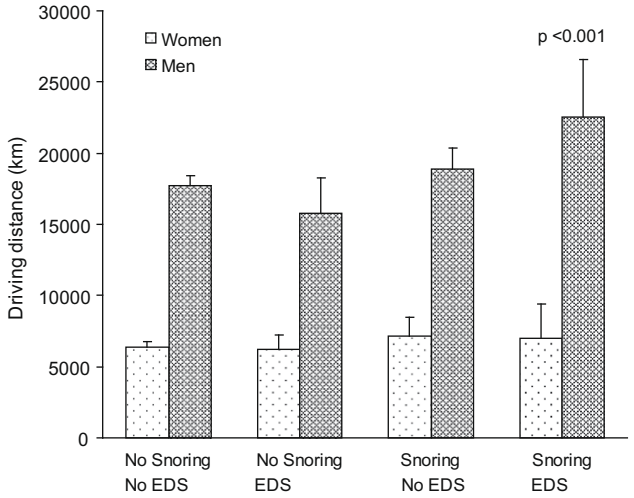

Fig. 1. Mean and 95% confidence interval of the distance driven in kilometers (km) a year among men and women with regard to snoring and excessive daytime sleepiness (EDS).