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Associations of common chronic non-communicable diseases and medical conditions with sleep-related problems in a population-based health examination study[☆]

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ABSTRACT

A cross-sectional population-based survey, the National FINRISK 2012 Study, designed to monitor chronic diseases and their risk factors in Finland. A random sample of 10,000 adults aged 25–74 years, and of them, 64% (n=6424) participated the study. Participants subjectively reported the total durations for sleep and naps (n=6238), sleep quality (n=5878), bedtimes and wake-up times separately for working days and weekends yielding the amount of sleep debt (n=5878), and the seasonal variation in sleep duration (n=4852). The participants were asked whether they were diagnosed or treated for common chronic diseases in the past 12 months. Logistic regression models were adopted to analysis and adjusted for a range of covariates as potential confounding factors. Total sleep duration and nap duration prolonged in depression and other mental disorder ($p < .001$ for all). Seasonal variation in sleep duration was associated with depression ($p=.014$), hypertension ($p=.018$) and angina pectoris ($p=.024$). Participants with gallstones, cardiac insufficiency, depression, or degenerative arthritis had poor sleep quality (odds ratios of 1.6–6.3, $p=.001$ or less for each). Those with degenerative arthritis had sleep debt less ($p < .05$) and those with angina pectoris more ($p < .05$) than individuals without these medical conditions. Depression is significantly associated with sleep problems, albeit no sleep debt. Cardiovascular diseases, degenerative arthritis, and gallstones had significant associations with one or more sleep problems. There is therefore a need for more successful management of sleep problems in chronic diseases to improve the quality of life, to reduce treatment relapses, and to increase health and longevity in a population.

1. Introduction

It is estimated that as high as a third of the general population suffers from sleep-related problems [1]. For example in Finland, around 10–14% of the adult population has reportedly suffered from insomnia-related symptoms [2] and 9% of daytime sleepiness [3]. Studies suggest that sleep-related problems are associated with lifestyle and socio-demographic factors such as smoking, exercise, gender, age, and education [2,4–7]. Besides, earlier studies also suggest that sleep-related problems and chronic non-communicable diseases have a bidirectional relationship: it can exacerbate chronic conditions, disrupt treatment, and increases social disability and vice versa [8–10].

Specifically, poor sleep prospectively associates with all-cause of mortality and morbidity, for example, by increasing inflammation, stress, blood pressure, impaired blood glucose control, and breathing problems [11–13]. Further, sleep-related problems decrease the quality of life and productivity and diminish the coping capacity for chronically ill patients, which in turn accelerate the disease's progression [14,15]. According to a most recent study, patients who have asthma, chronic lung disease, diabetes, and strokes reported significantly higher sleep problems [16]. Several other studies suggest that common pathophysiological mechanisms co-occur in sleep-related problems and chronic diseases [12,17]. However, it is not yet clear if the treatment of patients' sleep-related problems could result in

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significant clinical improvement and reduced mortality [15]. Nevertheless, understanding this relationship could give a new perspective on the course, outcomes, and treatment options. Therefore, in this study, we have examined the associations of sleep-related problems and some of the most common chronic non-communicable diseases and medical conditions in Finland.

2. Participants and methods

The National FINRISK Study is a large cross-sectional population-based survey on risk factors for chronic diseases. The surveys were conducted at five-year intervals since 1972 by using independent, random, and representative population samples. In 2012, ten thousand randomly chosen inhabitants, aged between 25 and 74 years old, were invited to participate in the survey. Based on the information provided by the Finnish Population Information System, the target survey sample was stratified, with strata of 2000 for five geographical areas each, according to the gender and 10-year age groups. Altogether 64% (n=6424) of those invited, participated the survey. The participants were asked to fill in the study questionnaires, which they had received beforehand by mail, and to participate in a health examination organized in a local health care center.

3. Sleep parameters

Information on the following sleep-related parameters was available: the total durations of sleep (in hours and minutes) and naps (in hours and minutes) from 6242 participants, the bedtimes (as clock time) and the wake-up times (as clock time) separately for weekdays and weekends, sleep debt (the sum of the differences in bedtimes and wake-up times during weekdays and weekends), and sleep quality as “Yes” or “No” to the question “Do you think you sleep enough?” from 5878 participants, the seasonal variations in sleep duration as scored on a Likert scale of 0 (no variation), 1 (slight variation), 2 (moderate variation) or 3 (marked variation) from 4852 participants.

4. Covariates

The National FINRISK 2012 study survey included a self-administered set of questionnaires with questions on socioeconomic factors, medical history, health behavior, and psychosocial factors, physical examination of health status, and laboratory measures for further analyses.

Socioeconomic covariates were age and body-mass index (BMI) as continuous variable, gender as male or female, marital status as living with somebody (either married, cohabitating or registered partnership) or alone (either single, separated or divorced, or widowed), education as low (less than four years of high school), medium (either high school only or 1–3 years post high school) or high level (4 or more years post high school), region as living in North Karelia & Kuopio, North Savo, Turku & Loimaa, Helsinki & Vantaa, or Oulu.

Lifestyle covariates were smoking as smokers (smoked daily or occasionally) and non-smokers (not at all), alcohol consumption as alcohol consumption (at least once or more than once a month) or no alcohol consumption (no alcohol consumption at all) and exercise as regular exercise (exercise several times a week or at least 3–4 h per week) or no-exercise (exercise less than 3 h per week).

Common chronic non-communicable diseases and medical conditions were assessed by responses to the question “Has a medical doctor diagnosed or treated you for any of the following diseases during the past year (last 12 months)?: Cardiovascular diseases (CVDs) symptoms including hypertension (increased blood pressure), high cholesterol, cardiac insufficiency, effort angina (angina pectoris), diabetes, cancer, bronchial asthma, chronic obstructive pulmonary disorders (COPD), gallstone (gallbladder inflammation), rheumatoid arthritis, other disease of the joints, degenerative arthritis of the back (other illness of the

back), depression, other psychological illnesses, renal failure, and proteinuria”. Responses were dichotomized into “Yes” and “No,” and this information was available from all the participants.

5. Statistical analyses

Logistic regression models with non-communicable chronic diseases and medical conditions as dependent and the sleep parameters as independent explanatory variables (total sleep and nap durations, sleep quality, bedtimes and wake-up times during weekdays and weekends, sleep debt, and the seasonal variation in sleep duration) were analyzed separately to calculate the odds ratio (OR) after controlling for the covariates (age, gender, education, marital status, region, alcohol consumption, smoking, physical activity, and BMI). Participants with good sleep quality and those with no seasonal variations in sleep duration were used as the reference categories in the analysis. The data were analyzed with IBM SPSS Statistics 21 software.

6. Ethics

The data collection was collected according to the guidelines of the Declaration of Helsinki and international ethical standards. The Ethics Committee of the Hospital District of Helsinki and Uusimaa evaluated and approved the research protocols. The ethical steering committee within National Institute for Health and Welfare gave permission for the sub-study and provided the data. All the participants gave a written informed consent either in Finnish or Swedish language.

7. Results

A total of 6424 participants completed the survey. The descriptive data on the background variables for the participants (3383 women and 3041 men) are given in Table 1, and those of their sleep in Table 2.

The timing of sleep was reported for weekdays and weekends separately for each chronic disease or medical condition (see supplementary tables 1–2). Concerning bedtimes, those with depression or other mental disorders had later bedtimes on weekdays and weekends when compared to those without disorders. Later bedtimes on weekdays were present also in those with cancer, COPD or gallstones, as compared with those not having these conditions. For the remaining, those having a medical condition had earlier bedtimes than those not having the medical condition in question. Concerning the wake-up time, those with depression or other mental disorder, bronchial asthma, or gallstones had a later wake-up time on weekdays as well as in weekend, as compared with those not having these conditions. Those having rheumatoid or degenerative arthritis had an earlier wake-up time both on weekdays and in weekend than those not having these conditions. For the remaining, those with a medical condition had a later wake-up time on weekdays but an earlier wake-up time in weekend, as compared with those not having the medical condition in question.

In the present study, total sleep duration was prolonged in most of the medical conditions and diseases assessed, significantly in depression ($p < .001$) and other mental health disorder ($p < .001$). Similarly, total naptime was prolonged in all the medical conditions and diseases, except in gallstones and rheumatoid arthritis, and significantly in depression ($p < .001$) and other mental health disorder ($p < .001$). Seasonal variation in sleep duration was significantly associated with angina pectoris ($p=.024$), depression ($p=.014$) and hypertension ($p=.018$). All the medical conditions and diseases had the increased odds for poor sleep quality, significantly in gallstones ($p=.001$), cardiac insufficiency ($p=.001$), depression ($p < .001$), and degenerative arthritis ($p < .001$). Participants with degenerative arthritis had sleep debt significantly less and those with angina pectoris significantly more than individuals without these medical conditions (see Table 3).

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