Sleep Medicine 23 (2016) 12–15

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Brief Communication

Daytime napping and increased risk of incident respiratory diseases: symptom, marker, or risk factor?

Yue Leng [a,*,1], Nick W.J. Wainwright [a], Francesco P. Cappuccio [b], Paul G. Surtees [a], Shabina Hayat [a], Robert Luben [a], Carol Brayne [c], Kay-Tee Khaw [a]

[a] Department of Public Health and Primary Care, Strangeways Research Laboratory, University of Cambridge, Cambridge, UK
[b] Division of Mental Health & Wellbeing, Warwick Medical School, University of Warwick, Coventry, UK
[c] Department of Public Health and Primary Care, Institute of Public Health, University of Cambridge, Cambridge, UK

ARTICLE INFO

Article history:
Received 24 March 2016
Received in revised form 11 June 2016
Accepted 30 June 2016
Available online 12 July 2016

Keywords:
Napping
Sleep
Respiratory
Incidence
Cohort study

ABSTRACT

Background: We have identified a strong association between daytime napping and increased mortality risk from respiratory diseases, but little is known about the relationship between daytime napping and respiratory morbidity.
Methods: Data were drawn from the European Prospective Investigation into Cancer and Nutrition-Norfolk cohort. Participants reported napping habits during 1998–2000 and were followed up for respiratory disease hospital admissions until March 2009. Cox proportional hazards regression was used to examine the association between daytime napping and respiratory disease incidence risk.
Results: The study sample included 10,978 men and women with a mean age of 61.9 years, and a total of 946 incident respiratory disease cases were recorded. After adjustment for age, sex, social class, education, marital status, employment status, nightshift work, body mass index, physical activity, smoking, alcohol intake, self-reported general health, hypnotic drug use, habitual sleep duration, and preexisting health conditions, daytime napping was associated with an increase in the overall respiratory disease incidence risk (hazard ratio (HR) = 1.32, 95% confidence interval (CI) 1.15, 1.52 for napping <1 h; HR = 1.54, 95% CI 1.14, 2.09 for napping ≥1 h). This association was more pronounced for lower respiratory diseases, especially for the risk of chronic lower respiratory diseases (HR = 1.52, 95% CI: 1.18, 1.96 for napping <1 h; HR = 1.72, 95% CI: 1.01, 2.92 for napping ≥1 h, overall $p = 0.003$).
Conclusions: Excessive daytime napping might be a useful marker of future respiratory disease incidence risk. Further studies are required to confirm these findings and help understand potential mechanisms.

1. Introduction

Despite growing interest in the influence of comorbid sleep disorders on the progression of respiratory diseases [1], the association between habitual sleep and the onset of respiratory diseases has rarely been studied. Our group has identified an intriguing association between daytime napping and increased mortality risk, particularly from respiratory diseases [2]. While the underlying mechanism remains unclear, the examination of the association between napping and respiratory disease would generate increased interest in the study of napping habits [3,4]. Daytime napping has been suggested as a marker of obstructive sleep apnea (OSA) [5], but it could also be a more global indicator of respiratory disease. Understanding the link between napping and respiratory morbidity might help with the early detection and control of respiratory disease. We therefore examined the association between daytime napping and the incidence risk of non-fatal respiratory diseases in the European Prospective Investigation into Cancer and Nutrition (EPIC)-Norfolk prospective cohort study [6].

2. Materials and methods

A total of 25,639 participants recruited through general practice registers attended the baseline health check in1993–1997 and were followed up for health outcomes. As part of the follow-up, participants were sent questionnaires for completion and returned by post. The Norwich District Ethics Committee approved the study and all participants gave signed informed consent. During 1998–2000, 16,374 participants completed the following question "Do you

Abbreviations: BMI, Body mass index; CI, Confidence interval; EPIC, European Prospective Investigation into Cancer and Nutrition; HR, Hazard ratio; OSA, Obstructive sleep apnea.

* Corresponding author. University of California, San Francisco, 4150 Clement Street, San Francisco, CA 94121, USA.
E-mail address: yue.leng@ucsf.edu (Y. Leng).
[1] Present address: University of California, San Francisco, 4150 Clement Street, San Francisco, 94121, CA, USA (Tel.: +14152214810; E-mail: yue.leng@ucsf.edu).

http://dx.doi.org/10.1016/j.sleep.2016.06.012

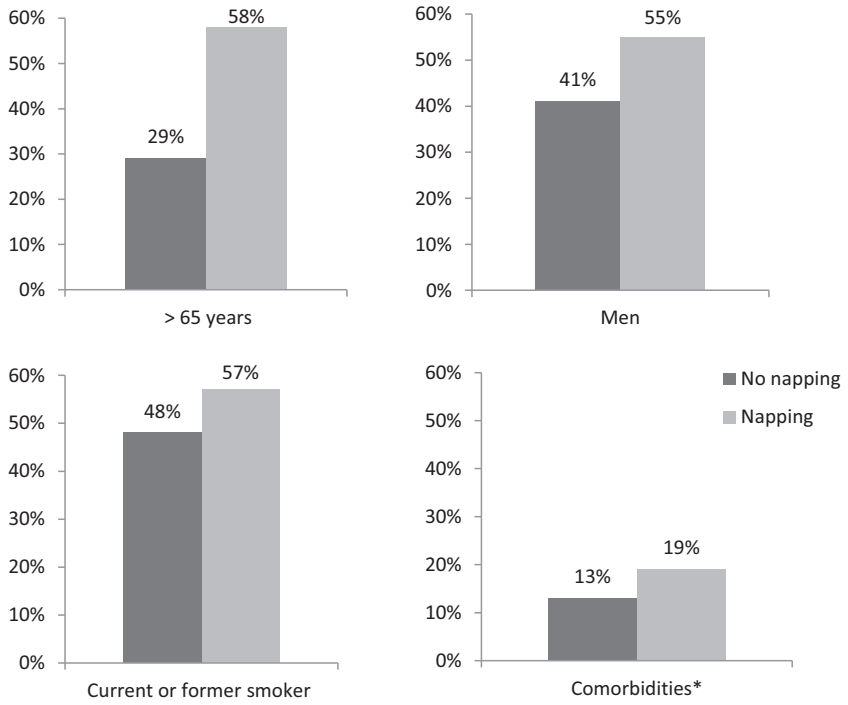

Fig. 1. Percentage of baseline characteristics by napping habits in 10,978 men and women, EPIC-Norfolk, United Kingdom, 1998–2000.
*Stroke, myocardial infarction, cancer, and underlying sleep apnea.
The association between napping and each characteristic was tested by Pearson's $\chi 2$ square test, all $P < 0.001$.

normally take a nap during the day?" and were asked to indicate the duration of their nap as either <1 h or ≥1 h if they reported napping. We obtained data on all hospital admissions through linkage with the National Health Services health district database. The UK Office of National Statistics flagged all participants according to the International Classification of Disease 10th Revision (ICD-10). All respiratory diseases were defined as J00-J99 and were subdivided into chronic lower respiratory diseases (J40-J47), lower respiratory infections (J10-J22, J85), and upper respiratory diseases (J00-J06, J30-J39). The current analysis presents hospital admissions for respiratory disease followed up from January 2000 until March 2009.

The association between daytime napping (summarized as no napping, napping <1 h/day, and napping ≥1 h/day) and respiratory disease incidence risk was examined using Cox regression. All covariates were chosen a priori and have been described in detail previously [2]. Analysis was confined to participants without self-reported respiratory diseases at the baseline and those with complete data on all covariates. The fully adjusted model included sociodemographic factors, body mass index (BMI), health-related behaviors, self-reported general health, habitual sleep duration, and comorbidities. The comorbidities included stroke, myocardial infarction, diabetes, cancer, and a proxy measure of OSA, with participants who were in the highest BMI quartile and who reported taking antihypertension drugs being defined as likely to have underlying OSA. Analyses were implemented in Stata, version 12.0 (StataCorp LP, College Station, Texas).

3. Results

After excluding participants with a history of asthma, bronchitis, and emphysema and those reporting chronic obstructive pulmonary disease (COPD) drug use at the baseline ($n = 2773$), the study sample consisted of 10,978 participants (4903 men and 6075 women, mean age 61.9 ± 9.0 years) with complete data on all covariates. At the baseline, 1700 (35%) men and 1400 (23%) women reported taking naps. Fig. 1 shows the percentage of certain baseline characteristics by napping. Those who reported napping were older, more likely to be men, smokers, and have comorbidities. Supplemental Table S1 summarizes the detailed relationship between covariates and napping habits. Those who reported long napping were more likely to have lower education, higher BMI, poorer general health, longer sleep duration, and be less active.

A total of 946 incident respiratory disease hospital admissions (including 286 from chronic lower respiratory diseases, 452 from lower respiratory infection, and 146 from upper respiratory diseases) were recorded over 9.25 years of follow-up. After adjustment for age and sex, napping was associated with a 40% (for napping <1 h/day) to 94% (for napping ≥1 h/day) increase in the overall respiratory disease incidence risk (Table 1). The association remained even after adjustment for all covariates (hazard ratio (HR) = 1.32, 95% confidence interval (CI) 1.15, 1.52 for napping <1 h; HR = 1.54, 95% CI 1.14, 2.09 for napping ≥1 h). This association was more pronounced for lower respiratory diseases, especially chronic lower respiratory diseases (for napping ≥1 h, HR = 1.72, 95% CI: 1.01, 2.92; overall $p = 0.003$).

When we examined two major chronic lower respiratory diseases separately, daytime napping (of any length) was associated with the risk of both COPD (HR = 1.64, 95% CI 1.17, 2.30) and asthma (HR = 1.50, 95% CI 1.07, 2.09) after multivariable adjustment.

4. Discussion

In this large prospective study of middle- to older-aged British adults, napping was associated with a 32–54% increase in the incidence risk of respiratory disease hospital admissions, independent of smoking, comorbidities, and habitual sleep duration. The risk of chronic lower respiratory disease was more than 70% higher among those who napped ≥1 h per day than among those who did not nap.

To our knowledge, this is the first study to report an association between daytime napping and increased incident respiratory diseases. Detailed hospital records on incident respiratory diseases