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# Sleep problems and sickness absence among middle-aged employees

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**Key terms:** health; health; health behavior; obesity; prospective study; sickness absence; sleep; sleep problem; working conditions

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# Sleep problems and sickness absence among middle-aged employees

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**Objective** The aim of this study was to examine whether sleep problems predict subsequent sickness absence among middle-aged public sector employees.

**Methods** The data included 5391 female and 1454 male employees of the City of Helsinki from questionnaire surveys at baseline in 2000–2002. These data were prospectively linked to the employer's sickness absence register data, with a mean follow-up time of 4.1 years. Using Poisson regression analysis, we examined associations between sleep problems (none, rare, occasional, and frequent), as indicated by the Jenkins Sleep Questionnaire, and self-certified short (1–3 days) and medically confirmed intermediate (4–14 days) and long (≥15 days) sickness absence spells. Sociodemographic factors, working conditions, work–family interface, health behaviors, and health status were obtained from the baseline surveys.

**Result** At baseline, 21% of women and 17% of men reported frequent sleep problems. Frequent sleep problems were associated with subsequent sickness absence spells irrespective of length of absence among both women and men after adjusting for age. After full adjustment for all covariates, the associations attenuated but remained for self-certified sickness absence [risk ratio (RR) for women 1.40, 95% confidence interval (95% CI) 1.25–1.56 and RR 1.59, 95% CI 1.24–2.03 for men], and medically confirmed intermediate (RR 1.34, 95% CI 1.17–1.52 and RR 1.35, 95% CI 1.02–1.77, for women and men, respectively) and long (RR 1.58, 95% CI 1.29–1.94 and RR 1.44, 95% CI 0.93–2.21, for women and men, respectively) sickness absence spells. Occasional sleep problems were also associated with sickness absence, but the associations were somewhat weaker.

**Conclusion** In occupational healthcare, sleep problems should be addressed to prevent their occurrence and subsequent ill-health and sickness absence.

**Key terms** health; health behavior; obesity; prospective study; sleep problem; sickness absence; working conditions.

Sleep problems consist of difficulties initiating and maintaining sleep or non-restorative sleep. The prevalence of sleep problems, referred to as insomnia symptoms, in the general population has been around 35%, with a range of 10–15% being assessed as chronic (1–4). During the past three decades, occasional sleep problems have been increasing among the working population in Finland, while prevalence of chronic sleep problems has remained relatively stable (1). It is therefore important to know whether sleep problems have consequences for health.

Sickness absence is a generic indicator of overall health, functioning, and work-related disability, and it predicts future health outcomes, such as self-rated health and mortality (5, 6). However, there is only limited evidence on the association between sleep problems and sickness absence. A study from Norway reported that sleep problems predicted sickness absence and that the association of sleep problems was stronger for sickness absence spells >90 days than for spells of 15–89 days (7). In Sweden, sleep problems have also been associated with increased risk of sickness absence spells

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of corresponding lengths (8). Another Swedish study focused on work-related sleep problems and reported strong cross-sectional associations between sleep problems and sickness absence in each three years studied: 1993, 1995, and 1999 (9). The associations were the strongest in 1999 among women and men. A Finnish study found that sickness absence days per month were significantly higher among those with sleep problems as compared to those reporting no sleep problems (10).

Recently, sleep disturbances have additionally been shown to be associated with a more severe outcome, namely, all-cause and cause-specific disability retirement (11–13), as well as a lowered likelihood of returning to work after sickness absence or disability retirement (11, 14). Such work disability events are likely preceded by prolonged sickness absence. Some other studies have also examined the associations between sleep, sickness absence, and work ability, but most of them have been small, used cross-sectional or self-reported data about sickness absence, or focused mainly on issues other than sickness absence (15–21). Only few studies on the association between sleep problems and subsequent sickness absence or work disability have controlled for several potential confounders such as sociodemographic factors, working condition, health behaviors, body weight, and baseline health (7, 10–13). In the previous Norwegian study about sleep and sickness absence (7), only employees aged 40–45 years were examined. Moreover, short (<2 weeks) sickness absence spells were not included. A recent Finnish study (11) focused only on very long sickness absences (≥3 months).

To examine whether sleep problems are similarly associated with subsequent sickness absence spells of various lengths, we extended the previous studies by using register-based longitudinal data comprising both self-certified short sickness absence spells and intermediate as well as long medically certified spells. The aim of this study was to examine whether (i) sleep problems are associated with subsequent short, intermediate, and long sickness absence spells among women and men and (ii) the associations remain after adjusting for various social and health-related covariates that have been shown to be associated with sleep problems and sickness absence.

## Methods

### Data

Data from the Helsinki Health Study on the staff of the City of Helsinki, Finland, were used. Sleep problems, sociodemographic factors, working conditions, work–family interface, health behaviors, obesity, and physical and mental health were obtained from independent cross-sectional baseline questionnaire surveys in 2000, 2001, and 2002 among 40, 45, 50, 55 and 60 year-old employees (22). The overall response rate was 67% (N=8960). Baseline characteristics of the respondents by sleep problems are presented in table 1 and have been reported elsewhere as well (13, 23, 24).

The survey data were prospectively linked to sickness absence registers of the city of Helsinki using the unique personal identification numbers for those providing written consent for such linkage (78%). Sickness absence data could not be obtained for 16 respondents whose questionnaires lacked identification. Thus, this study includes 5391 women and 1454 men, reflecting the gender distribution among the staff of the city of Helsinki.

Non-response analysis showed that the baseline data satisfactorily represent the target population (25). Men, younger people, manual workers, and those with low income and long sickness absence spells were slightly underrepresented among the respondents. The associations of the background characteristics with sickness absence were, however, similar among the respondents and non-respondents. Consenting for data linkage did not cause substantial bias.

### Sickness absence

The procedures for recording sick leave in the Finnish municipal sector can be regarded as reliable. Each absence spell of an employee is recorded including the dates of the start and end time. For spells ≤3 days, employees complete their own certificates. For spells >3 days, medical certification is required. We examined separately self-certified short (1–3 days) and medically confirmed intermediate (4–14 days) and long (≤15 days) sickness absence spells. The follow-up started from the day the respondent returned the baseline questionnaire and continued until the end of 2005 or when the work contract terminated. Absences due to a child's sickness were excluded and all interruptions in work due to reasons other than own illnesses were subtracted from the follow-up time. The average follow-up time was 4.1 years.

### Sleep problems

The 4-item Jenkins Sleep Questionnaire (26) was used to examine the sleep problems during the previous four weeks. The four items were: (i) having trouble falling asleep; (ii) waking up several times per night; (iii) having trouble staying asleep; and (iv) feeling tired and worn out when waking up after the usual amount of sleep. Six response alternatives were: 1=not at all; 2=1–3 days; 3=4–7 days; 4=8–14 days; 5=15–21 days; and 6=22–28 days. The participants were classified as having frequent

sleep problems if they reported any of the sleep problems occurring every or almost every night (responses 5 or 6). Those who reported any sleep problem 1–3 times during the previous month were classified as having rare sleep problems, whereas occasional sleep problems referred to sleep problems occurring 4–14 times over the previous month. Those who responded "not at all" to all the items were classified as not having sleep problems and served as a reference group. One missing response to any of the four items was allowed. Standardized Cronbach's α coefficient was 0.84 for the four items. Correlations between the items varied from 0.48–0.70.

Our measure on sleep problems is a proxy of Diagnostic and Statistical Manual of Mental Disorders (DSM–IV–TR) criteria for insomnia. We also examined the associations using a summed score across the four items. Thus the responses to each item were summed and the sum score was divided into four groups. The results for individual items were very similar to the ones reported in this paper. We also examined all of the associations for each item separately (using four corresponding categories of no, rare, occasional, and frequent sleep problems with short-, intermediate-, and long-absence spells, models 1–5). The results were very similar for each item too. This suggests that our results are not sensitive to the classification and that each of these sleep problems likely capture insomnia symptoms and are associated with subsequent sickness absence.

### Background variables

Background factors have been previously reported in more detail elsewhere (13, 24). Work arrangements included weekly working hours and doing shift work. Working hours were measured by a 5-point scale ranging from 1–>50 hours a week. The cut-off point for long working hours was >40 hours a week. Current working schedule was categorized as: (i) regular daytime work, (ii) shift work with no night shifts, (iii) shift work with night shifts including regular night work, and (iv) other work time arrangements.

Physical working conditions were based on an 18-item inventory of environmental and physical exposures at work (27). A three-factor solution was reached from factors analysis. The first factor comprised work environmental exposures, such as to hazardous chemicals, climate, and noise. The second factor comprised physical workload, such as uncomfortable postures, repetitive trunk rotation, repetitive movements, standing, lifting, and carrying. The third factor comprised working with computer and mouse and sitting. Factor scores for all three factors were divided into quartiles and included as class variables in all analyses.

Job strain was assessed by using job demands and job control scales both consisting of nine items from the Job Content Questionnaire (28). The responses to all items were summed up and the median of the summed score was used as cut-off point for high job demands and control to produce four categories of Karasek's job strain model: low job strain, passive work, active work, and high job strain (29).

Marital status was divided into married or cohabiting, single, and previously married (divorced, separated, or widowed).

Work–home interface was measured with an item asking how satisfied the respondent was with combining paid work and family life (seven response alternatives ranging from "very satisfied" to "very dissatisfied").

Smoking was dichotomized to current smokers and non-smokers. The alcoholic content of beer, wine, and spirits was multiplied by the number of units consumed during an average week, and heavy drinking was measured as consumption of >280 grams of pure alcohol per week for men and 140 grams per week for women. Body mass index (BMI=kg/m$^2$) was based on self-reported height and weight. Obesity was defined as BMI ≥30 kg/m$^2$.

Health status at baseline was measured by self-reported lifetime chronic diseases diagnosed by physician including diabetes, cardiovascular diseases, asthma, and mental disorders including depression, anxiety, and any other mental health problem (responses were "yes", "no", or no response).

### Statistical analysis

Sickness absence rates for short, intermediate, and long sickness absence spells were first calculated in the four groups of sleep problems and for all men and women. The rates are reported per 100 person-years.

The associations of sleep problems with sickness absence were then examined by Poisson regression analysis. The number of sickness absence spells during the follow-up period was used as the outcome variable. This outcome effectively uses the information when one individual has several sickness absence spells and it is not dominated by only a few prolonged absence spells. Differences in the individual follow-up times were taken into account using the logarithm of the time until censoring as the offset. Overdispersion was moderate and standard errors were corrected by scaling. We first fitted age-adjusted base models showing rate ratios (RR) with 95% confidence intervals (95% CI) for sleep problems categories compared to those with no sleep problems. We then examined how adjusting for sociodemographic factors, working conditions, work–family interface, health behaviors, obesity, and health status affected this association. All analyses were conducted separately for women and men using SAS version 9.2 for Windows (SAS Institute Inc, Cary, NC, USA).

## Results

At baseline, 21% of women and 17% of men reported frequent sleep problems. Around 32–34% of women and men had rare or occasional sleep problems, and only 13% of women and 17% of men did not report any sleep problems. Among women, sleep problems were more prevalent among: (i) older age groups, (ii) the divorced and widowed, (iii) those working overtime, (iv) those with environmental, physical, computer and psychosocial workload, (v) those having work–family conflicts, (vi) current smokers, (vii) heavy drinkers, (viii) the obese, and (ix) those with a physician-diagnosed somatic or mental disease (table 1). Similar associations were found among men, however, there was no age pattern and no associations by smoking, but single men reported sleep problems more often.

During the follow-up, we recorded 5599 self-certified spells of sickness absence (138/100 person years on average), 4404 medically certified absence spells of 4–14 days (56/100 person years on average), and 2767 absence spells of ≥2 weeks (21/100 person years on average). The number of sickness absence spells was higher among women than men, and the longer the sickness absence spells, the lower the incidence (table 2). Furthermore, there was a strong association between sleep problems and the incidence of sickness absence among both women and men. Among women, the number of short sickness absence spells per 100 person years ranged from 114, among those with no sleep problems, to 174, among those with frequent sleep problems: among men, the range was 71–127. Corresponding figures for intermediate spells (4–14 days) were 48–71 for women and 33–59 for men. For the long spells (≥15 days), the figures were 15–32 and 15–25 for women and men, respectively.

Among participants reporting frequent sleep problems, compared with the reference group after adjusting for age, women had a 63% increased risk (RR=1.63, 95% CI 1.45–1.83), and men about a twofold risk (RR=1.81, 95% CI 1.40–2.34) for self-certified short sickness absence (table 3, model 1). Adjusting for sociodemographic factors and working conditions slightly attenuated the associations for frequent sleep problems (model 2), whereas the effects of health behaviors and obesity were negligible (model 3). Adjusting further for baseline health and all the covariates simultaneously (model 4) attenuated the associations but frequent sleep problems remained associated with self-certified short sickness absence among women (RR=1.40, 95% CI 1.25–1.56) and men (RR=1.59, 95% CI 1.24–2.03).

Also occasional sleep problems were associated with self-certified short sickness absence among women (RR=1.40, 95% CI 1.26–1.56) and men (RR=1.31, 95%

**Table 1.** Distribution of covariates and prevalence of frequent sleep problems among women (N=4890) and men (N=1349).

| | | | Frequent sleep problems | |
|---|---|---|---|---|
| | Women (%) | Men (%) | Women (%) | Men (%) |
| Age (in years) | | | | |
| 40 | 21 | 18 | 16 | 19 |
| 45 | 22 | 19 | 17 | 15 |
| 50 | 22 | 21 | 23 | 17 |
| 55 | 24 | 27 | 24 | 17 |
| 60 | 11 | 15 | 28 | 18 |
| Marital status | | | | |
| Married | 68 | 78 | 20 | 16 |
| Single | 13 | 11 | 19 | 21 |
| Divorced & widowed | 18 | 11 | 24 | 22 |
| Occupational class | | | | |
| Managers & professionals | 29 | 46 | 21 | 16 |
| Semi-professionals | 20 | 20 | 21 | 20 |
| Routine non-manuals | 41 | 9 | 20 | 16 |
| Manual workers | 11 | 25 | 23 | 21 |
| Working overtime | | | | |
| No (1—40 hours a week) | 87 | 79 | 20 | 16 |
| Yes (≥41 hours a week) | 13 | 21 | 24 | 19 |
| Shift work | | | | |
| No | 79 | 71 | 21 | 16 |
| Shift work (no nightwork) | 12 | 11 | 23 | 20 |
| Shift work (incl nightwork) | 6 | 14 | 16 | 18 |
| Other | 3 | 4 | 23 | 22 |
| Environmental exposures | | | | |
| Lowest quartile | 25 | 26 | 18 | 9 |
| 25—<50% | 25 | 26 | 19 | 17 |
| 50—<75 | 25 | 25 | 23 | 16 |
| Highest quartile | 25 | 24 | 24 | 26 |
| Physical workload | | | | |
| Lowest quartile | 25 | 25 | 18 | 12 |
| 25—<50% | 25 | 25 | 19 | 13 |
| 50—<75 | 25 | 26 | 19 | 18 |
| Highest quartile | 25 | 24 | 28 | 25 |
| Computer work | | | | |
| Lowest quartile | 24 | 24 | 19 | 18 |
| 25—<50% | 25 | 26 | 18 | 11 |
| 50—<75 | 26 | 25 | 19 | 17 |
| Highest quartile | 25 | 25 | 27 | 22 |
| Psychosocial job strain | | | | |
| Low job strain | 27 | 27 | 15 | 10 |
| Passive work | 26 | 29 | 20 | 18 |
| Active work | 27 | 26 | 22 | 18 |
| High job strain | 21 | 18 | 28 | 24 |
| Work–family conflicts | | | | |
| Satisfied | 50 | 47 | 16 | 12 |
| Intermediate | 42 | 44 | 23 | 18 |
| Dissatisfied | 9 | 9 | 41 | 34 |
| Current smoking | | | | |
| No | 78 | 73 | 20 | 17 |
| Yes | 22 | 27 | 23 | 17 |
| Alcohol drinking | | | | |
| Moderate drinker | 93 | 92 | 20 | 17 |
| Heavy drinker | 7 | 8 | 27 | 20 |
| Body mass index (BMI) | | | | |
| Normal weight | 86 | 85 | 20 | 15 |
| Obese (BMI <30) | 14 | 15 | 26 | 25 |
| Physician-diagnosed diseases | | | | |
| Asthma | | | | |
| No | 83 | 88 | 20 | 16 |
| Yes | 8 | 5 | 27 | 21 |
| No response | 9 | 7 | 27 | 27 |

(cont)

**Table 1.** Continued

| | | | | |
|---|---|---|---|---|
| Diabetes | | | | |
| No | 88 | 90 | 20 | 16 |
| Yes | 2 | 3 | 26 | 21 |
| No response | 10 | 7 | 27 | 26 |
| Cardiovascular disease | | | | |
| No | 83 | 83 | 20 | 16 |
| Yes | 7 | 9 | 24 | 21 |
| No response | 11 | 9 | 24 | 24 |
| Mental disease | | | | |
| No | 75 | 83 | 17 | 14 |
| Yes | 17 | 12 | 38 | 34 |
| No response | 8 | 6 | 21 | 24 |

**Table 2.** Sickness absence spells/100 person years by sleep problems among 40–60-year-old employees

| | Sickness absence spells/100 person years | | | | |
|---|---|---|---|---|---|
| | No sleep problems | Rare sleep problems | Occasional sleep problems | Frequent sleep problems | All |
| Women (N=5391) | | | | | |
| 1–3 days | 113.6 | 137.8 | 160.7 | 174.4 | 149.4 |
| 4–14 days | 47.7 | 54.1 | 61.2 | 71.4 | 59.7 |
| ≥15 days | 14.8 | 17.3 | 21.4 | 31.9 | 21.5 |
| Men (N=1454) | | | | | |
| 1–3 days | 70.6 | 84.7 | 96.2 | 127.2 | 92.7 |
| 4–14 days | 33.0 | 35.1 | 38.3 | 58.9 | 39.6 |
| ≥15 days | 15.0 | 14.9 | 16.1 | 25.1 | 17.3 |

CI 1.03–1.67) after adjusting for age (table 3, model 1). Adjusting for covariates (models 2–4) made a modest contribution to these associations. Among women and men, an association was also found when those reporting rare sleep problems were compared to those with no problems. Among women, this association remained when we adjusted for all the covariates, and, among men, the association slightly strengthened after full adjustment.

Women (RR=1.59, 95% CI 1.38–1.83) and men (RR=1.75, 95% CI 1.28–2.39) reporting frequent sleep problems had higher risk for intermediate sickness absence spells after adjusting for age (table 4, model 1). Contribution of sociodemographic factors, working conditions, work–home interface (model 2), as well as health behaviors and obesity (model 3) were similar to those shown for the short sickness absence spells. After further adjusting for baseline health (model 4), the association attenuated but remained (for women RR=1.34, 95% CI 1.17–1.52; for men RR=1.35, 95% CI 1.02–1.77 ).

Women reporting occasional sleep problems had a 30% increased risk for medically confirmed intermediate (4–14 days) sickness absence compared with those reporting no sleep problems (table 4). The association survived all the adjustments, but somewhat attenuated when all the covariates were simultaneously taken into account (RR=1.21, 95% CI 1.08–1.37, model 4). Among men, no associations were found between rare or occasional sleep problems and intermediate sickness absence spells.

The association between sleep problems and long (≥15 days) sickness absence spells was slightly stronger than that of intermediate spells (table 5). Those reporting frequent sleep problems had a two-fold risk for long sickness absence among both women (RR=2.08, 95% CI 1.67–2. 85) and men (RR=1.85, 95% CI 1.17–2.92). After full adjustments (model 4), the association again attenuated but remained both among women (RR=1.58, 95% CI 1.29–1.94) and men (RR=1.44, 95% CI 0.93–2.21).

Women reporting occasional sleep problems had a 41% higher risk for long sickness absence compared to those with no sleep problems (table 5). This association remained after full adjustment (RR=1.22, 95% CI 1.00–1.49). Rare sleep problems were not associated with long sickness absence spells. Among men, the pattern concerning occasional sleep problems was similar to that of women, but statistically significant associations between rare and occasional sleep problems were non-existent.

## Discussion

This study aimed to examine the associations of sleep problems with subsequent sickness absence of various lengths in a large cohort of middle-aged public sector employees. The first main finding was that sleep problems were associated with sickness absence and that the associations were largely similar for all absence spells. The second main finding was that the association remained when sociodemographic factors, working conditions, health behaviors, obesity, as well as mental and physical health at baseline were taken into account. However, in particular sociodemographic factors and working conditions as well as baseline physical and mental health problems attenuated the association, whereas the effect of health behaviors and obesity was negligible. The third main finding was that the associations were mostly similar among men and women, although a smaller number of men contributed to wider confidence intervals and lack of statistical power.

Our results are in line with previous studies (7–11) confirming the significance of sleep problems to sickness absence across cohorts, countries, and various age groups. Furthermore, our study added to previous evidence by showing that the association was equally strong for self-certified short spells and thus the association does not concern severe conditions as indicated by longer absence spells only. Additionally, in ours as

**Table 3.** Sleep problems and self–certified short sickness absence spells (1–3 days) among 40–60-year–old employees. [RR=rate ratio; 95% CI=95% confidence interval.]

| | Model 1 [a] | | Model 2 [b] | | Model 3 [c] | | Model 4 [d] | |
|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Women (N=4890) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.19 | 1.07–1.33 | 1.14 | 1.02–1.27 | 1.15 | 1.04–1.28 | 1.14 | 1.03–1.27 |
| Occasional sleep problems | 1.40 | 1.26–1.56 | 1.35 | 1.21–1.50 | 1.35 | 1.21–1.49 | 1.29 | 1.16–1.43 |
| Frequent sleep problems | 1.63 | 1.45–1.83 | 1.54 | 1.38–1.73 | 1.52 | 1.36–1.69 | 1.40 | 1.25–1.56 |
| Men (N=1349) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.18 | 0.93–1.51 | 1.18 | 0.93–1.49 | 1.23 | 0.98–1.55 | 1.26 | 1.00–1.57 |
| Occasional sleep problems | 1.31 | 1.03–1.67 | 1.30 | 1.03–1.64 | 1.32 | 1.05–1.66 | 1.31 | 1.05–1.64 |
| Frequent sleep problems | 1.81 | 1.40–2.34 | 1.67 | 1.29–2.15 | 1.68 | 1.31–2.16 | 1.59 | 1.24–2.03 |

[a] Age-adjusted.
[b] Model 1 + marital status, occupational class, work arrangements, physical working conditions, job strain, and work–family interface.
[c] Model 2 + health behaviors and obesity.
[d] Model 3 + health (asthma, cardiovascular disease, Type II diabetes, mental health).

**Table 4.** Sleep problems and medically confirmed intermediate sickness absence spells (4–14 days) among 40–60-year–old employees. [RR=rate ratio; 95% CI=95% confidence interval.]

| | Model 1 [a] | | Model 2 [b] | | Model 3 [c] | | Model 4 [d] | |
|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Women (N=4890) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.15 | 1.01–1.32 | 1.08 | 0.95–1.22 | 1.10 | 0.97–1.24 | 1.10 | 0.97–1.23 |
| Occasional sleep problems | 1.30 | 1.14–1.49 | 1.28 | 1.13–1.45 | 1.28 | 1.13–1.45 | 1.21 | 1.08–1.37 |
| Frequent sleep problems | 1.59 | 1.38–1.83 | 1.49 | 1.30–1.70 | 1.47 | 1.29–1.67 | 1.34 | 1.17–1.52 |
| Men (N=1349) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.08 | 0.80–1.45 | 1.15 | 0.89–1.49 | 1.19 | 0.92–1.53 | 1.19 | 0.92–1.52 |
| Occasional sleep problems | 1.13 | 0.84–1.52 | 1.18 | 0.91–1.54 | 1.18 | 0.92–1.53 | 1.15 | 0.90–1.48 |
| Frequent sleep problems | 1.75 | 1.28–2.39 | 1.50 | 1.13–1.99 | 1.44 | 1.09–1.90 | 1.35 | 1.02–1.77 |

[a] Age-adjusted
[b] Model 1 + marital status, occupational class, work arrangements, physical working conditions, job strain, and work–family interface
[c] Model 2 + health behaviors and obesity
[d] Model 3 + health (asthma, cardiovascular disease, Type II diabetes, mental health).

**Table 5.** Sleep problems and medically confirmed long sickness absence spells (≥15 days) among 40–60-year–old employees. [RR=rate ratio; 95% CI=95% confidence interval.]

| | Model 1 [a] | | Model 2 [b] | | Model 3 [c] | | Model 4 [d] | |
|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Women (N=4890) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.15 | 0.93–1.43 | 1.05 | 0.86–1.28 | 1.07 | 0.87–1.31 | 1.06 | 0.87–1.29 |
| Occasional sleep problems | 1.41 | 1.14–1.74 | 1.31 | 1.07–1.61 | 1.31 | 1.07–1.60 | 1.22 | 1.00–1.49 |
| Frequent sleep problems | 2.08 | 1.67–2.58 | 1.83 | 1.49–2.25 | 1.78 | 1.45–2.19 | 1.58 | 1.29–1.94 |
| Men (N=1349) | | | | | | | | |
| No sleep problems (reference) | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Rare sleep problems | 1.12 | 0.73–1.74 | 1.16 | 0.78–1.72 | 1.21 | 0.81–1.79 | 1.25 | 0.84–1.84 |
| Occasional sleep problems | 1.23 | 0.80–1.91 | 1.27 | 0.85–1.90 | 1.30 | 0.87–1.93 | 1.27 | 0.86–1.88 |
| Frequent sleep problems | 1.85 | 1.17–2.92 | 1.61 | 1.04–2.48 | 1.56 | 1.01–2.40 | 1.44 | 0.93–2.21 |

[a] Age-adjusted
[b] Model 1 + marital status, occupational class, work arrangements, physical working conditions, job strain, and work–family interface.
[c] Model 2 + health behaviors and obesity
[d] Model 3 + health (asthma, cardiovascular disease, Type II diabetes, mental health)

in some previous studies about sickness absence or work disability, a variety of potential covariates – such as working conditions, health behaviors, and health – were adjusted for, but the associations remained (7, 10, 11, 13).

The fact that sleep problems are co-morbid with a variety of chronic conditions raises the question of their independent effect on health-related outcomes (30). We could partly rule out the possibility of confounding due to medical co-morbidity. The associations remained after taking into account pre-existing diabetes, cardiovascular diseases, asthma, and previous mental health problems.

A previous study found that both sleep problems and fatigue were associated with subsequent long sickness absence (8). The associations between both sleep problems and fatigue with sickness absence attenuated but remained after mutually adjusting for both measures. The study concluded that sleep problems likely contribute to fatigue and thereby sickness absence. The study, however, focused on long (14–89 days) and very long (>90 days) sickness absence, and it is possible that the effects of fatigue and causal chain between sleep, fatigue, and sickness absence vary by length of absence. Although our measures on health-related covariates are often used, they are based on single-item questions and thus do not necessarily capture all the effects of ill-health on the association between sleep problems and sickness absence.

Although there was no statistically significant interaction between sleep problems and sex, the analyses were stratified by sex. This was done as women have more sickness absence spells than men (31) and because our data were female dominated. Thus the associations in the pooled data reflect the results found among women.

A limitation of our study is the relatively homogenous cohort of public sector employees aged ≥40 years. The picture might be different for other employment sectors, geographical areas, and age groups. However, the City of Helsinki is the largest employer in Finland with nearly 40 000 employees, and hundreds of different occupations titles are represented. Sleep problems significantly increase after the age of 40 (32), making our age group and the consequences of sleep problems relevant. Additionally, we showed a pronounced gradient in the association. Thus occasional and frequent sleep problems are both of importance to subsequent sickness absence. Concerning short self-certified spells, even rare sleep problems may play a role. However, the estimates were at the same level for intermediate and long spells, but due to the lower number of such spells, level of statistical significance was not reached.

As employees can report sick 1–3 days without a medical certificate, it is also possible that transient sleep problems are one potential reason for such short absence spells. Previous studies have used less specified classification of sleep problems and short absence spells have not been included. The significance of intensity, severity, and duration of sleep problems for subsequent sickness absence of various lengths needs, therefore, further scrutiny and corroboration. A further limitation is that sleep duration and sleep apnea were not examined. However, our previous (33) study on the joint association of sleep duration and sleep problems with disability retirement showed that, among short, long, and intermediate sleepers, only those who reported sleep problems were at risk for disability retirement. In turn, prevalence of apnea is very low and apnea is largely related to obesity. As we adjusted for BMI, this may partly serve as a proxy for the lack of this sleep measure. Nonetheless, this study cannot rule out that the examined sleep problems overlap with sleep apnea. Finally, it is a limitation of this study that we lack data about diagnoses related to examined sickness absence. However, detailed data about all sickness absence spells of various lengths were derived from employer's register. This is an advantage over earlier studies that lacked data concerning shorter spells.

The strengths of this study include the relatively large sample, register-based data on sickness absence, and a prospective study design. Data about sleep problems, as well as working conditions, family-related factors, and health behaviors were based on self-reports, and the extent to which they are inadequately reported reduces their reliability. Yet, the indicators were measured using standard survey methodology with established, reliable and validated instruments (26, 28). Furthermore, we were able to examine various lengths of sickness absence spells and identify both self- and medically certified absences.

### Concluding remarks

Sleep problems were associated with sickness absence among middle-aged women and men even after other risk factors were considered. The association was broadly similar for short, intermediate, and long-term sickness absence spells based on self- and medical certification. Frequent and even occasional sleep problems need more attention in occupational healthcare to be able to help prevent sickness absence and its economical consequences, as well as to promote well-being and health among employees.

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