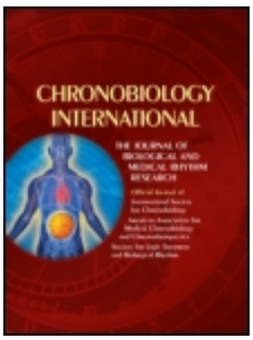

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Association of Sickness Absence with Poor Sleep and Depressive Symptoms in Shift Workers

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ABSTRACT

A cross-sectional study was conducted to evaluate the contribution of daily sleep habits and depressive symptoms to sickness absences of shift workers. A self-administered questionnaire that solicited answers about sleep, symptoms of depression, sickness absence, diseases/injuries, and lifestyle factors was submitted to a sample of 522 rotating shift workers between the ages of 18–59 (mean 27) yrs of an electric equipment manufacturing company. The seven features of sleep queried were daily hours of sleep, time to fall asleep, awakening

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during sleep, early morning awakening, sleep well at night, sufficiency of sleep, and excessive daytime sleepiness at work. The responses were assessed over the subject's previous 1-yr period. Each sleep feature, except daily sleeping hours, was dichotomized by the following responses: (1) taking more than 30 min to fall asleep (difficulty initiating sleep; DIS), (2) awakening during sleep almost every day (difficulty maintaining sleep; DMS), (3) early morning awakening almost every day (EMA), (4) sleeping very poorly or not so well at night, (5) definite or somewhat insufficient nightly sleep, and (6) excessive daytime sleepiness at work almost every day (EDS). Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression (CES-D) scale. Sickness absence was calculated by asking subjects "How many days in total have you been absent from work due to sickness, including paid vacation, in the last 1-yr period?" The responses were divided into three groups that included no (0 days) sickness absences (reference group, $n = 235$ subjects), 1 to 4 days (short-term, $n = 199$ subjects), and 5 days or more (long-term, $n = 88$ subjects). Compared to the prevalence of sleep features of the reference group, workers with short-term absence showed a significantly higher prevalence of EMA with an odds ratio (OR) of 5.3, 95% confidence interval (CI) 1.3–22.0. Long-term absence was significantly associated with DMS (OR = 2.1, 95%CI 1.0–4.6), EMA (OR = 5.6, 95%CI 1.0–28.7), sleeping poorly at night (OR = 2.6, 95%CI 1.4–5.0), and high depressive symptoms (OR = 2.0, 95%CI 1.0–3.7) according to the CES-D score of $\geq$16, after adjusting for multiple confounding variables. These data point to an association between both the parameters of poor sleep and symptoms of deep depression when self-reported sickness absence is frequent. The association is particularly strong with long-term absence in male shift workers.

Key Words: Shift work; Sickness absence; Sleep; Depressive symptoms; Male; Occupational medicine.

INTRODUCTION

Absence from work because of sickness is a health indicator and is an expensive problem that is on the increase in industrialized countries. Previous epidemiologic studies have identified aging (Mastekaasa, 2000; Sandanger et al., 2000), disease/injury (Borg et al., 2001; Marmot et al., 1995; Stansfeld et al., 1995), female gender (e.g., Sandanger et al., 2000), low socioeconomic status (Feeney et al., 1998; North et al., 1996), poor psychosocial work environment (Niedhammer et al., 1998; North et al., 1996; Rael et al., 1995), and unhealthy behavior evidenced by smoking and frequent alcohol consumption (Vasse et al., 1998; Parkes, 1987) as potential risk factors for sickness absence.

Several studies have found higher rates of sickness absences in shift as compared to day workers (Ohayon et al., 2002; Morikawa et al., 2001; Taylor et al., 1972), but other studies have shown no difference or even lower absence rates (Kleiven et al., 1998; Fujita et al., 1993; Koller, 1983; Pocock et al., 1972). Disturbed sleep and sleepiness are major consequences of shift work as reported elsewhere (e.g., Harma et al., 1998; Åkerstedt, 1995) as well as in this proceedings (Ingre et al., 2004; Menezes et al., 2004; Portela et al., 2004; Rajaratnam and Jones et al., 2004; Santos

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et al., 2004; Teixeira et al., 2004a, 2004b), and it is expected that shift workers with poor sleep will more likely be absent from work than workers with adequate sleep.

It is important to systematically investigate whether there is an association of sleep problems and sickness absence. Several studies have been conducted on day workers. Leigh (1991) suggested that insomnia was the second most common contributing factor to sickness absence in a sample of 1,308 employed men and women in the United States. Philip et al. (2000) found that employees who reported severe daytime somnolence 3 or more days per week had a two-fold greater sickness absence rate than those with no daytime somnolence during the previous 1 yr. More recently, Doi et al. (2002) reported that white-collar workers with poor sleep quality took sickness absence nearly twice as often as those with adequate sleep. While not conclusive, these findings strongly suggest that poor sleep or sleep problems result in sickness absence in day workers.

Sleep problems, especially insomnia symptoms, are a well-known feature of depressive disorders (e.g., Vollrath et al., 1989; Marmot et al., 1995). Depressive disorders and symptoms have also been linked with sickness absences (Laitinen–Krispijn and Bijl, 2000; Kopp et al., 1995). However, it is still not well understood which of the symptoms, i.e., insomnia or depression, is more strongly associated with either long- or short-term sickness absences.

Potential relationships between various aspects of sleep and depressive symptoms that contribute to sickness absence in shift-work populations are unknown and yet to be studied. We conducted a cross-sectional survey of male shift workers employed in an electric equipment manufacturing company in Japan. Daily sleeping hours, length of time to fall asleep, frequency of awakening during sleep and early morning awakening, sufficiency of sleep, sleeping well at night, excessive daytime sleepiness at work as well as depressive symptoms were investigated in this study. Sociodemographics, lifestyle, psychosocial, and physical/psychological conditions were included as confounding factors. We hypothesized that poor sleep habits and depressive symptoms are important risk factors for sickness absence in shift workers.

SUBJECTS AND METHODS

Subjects

A total of 2,625 full-time workers, 18–59 yrs of age, employed in a Japanese electric equipment manufacturing company participated in the study. The workers were surveyed in April 1997 by soliciting responses to a mailed questionnaire for information concerning sociodemographics, sickness absence, sleep features, current type of job, work schedule, job stress, depressive symptoms, life-style factors, and diseases/injuries (Table 1). A total of 2,420 (92.2%) workers responded to the survey. Since our primary goal was to identify an association of sleep features with sickness absence in the shift-work population, day workers ($n = 1{,}777$) were not included. Female shift workers were excluded because of their small number ($n = 56$). Fifty workers failed to answer all the questions concerning demographic information, shift work, and/or job types and thus were eliminated from the analyses. Fifteen workers

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Table 1. Covariates in study population of 522 male shift workers of an electric equipment manufacturing company.

Variable	*N* (%)	Mean (SD, range)
Age, yrs		27.0 (5.6, 18–59)
18–29	389 (74.5)	
30–39	114 (21.8)	
40–49	16 (3.1)	
50–59	3 (0.6)	
Job types		
Mechanics/repair	75 (14.4)	
Machine operator	395 (75.7)	
Manual laborer	17 (3.3)	
Others	35 (6.7)	
Marital status		
Married	190 (36.4)	
Not married	332 (63.6)	
Education (yrs)		
5–9	12 (2.3)	
10–12	500 (95.8)	
13^{+}	10 (1.9)	
JCQ scales		
Job control		58.6 (9.8, 26–90)
Job demands		32.7 (4.9, 18–48)
Social support at work		21.8 (3.2, 8–32)
Other covariates		
Smoking (number of cigarettes smoked/day)		8.8 (9.3, 0–40)
Alcohol consumption (g ethanol/week)		35.9 (60.2, 0–788)
Caffeine intake (cups of coffee or tea/day)		2.7 (1.0, 0–6)
Leisure time physical exercise (times/month)		3.1 (5.3, 0–30)
Overtime work (hours/month)		5.5 (11.2, 0–176)
Presence of physical/psychological diseases/injuries (Yes)	175 (33.5)	

SD = Standard deviation.

who did not provide any answers about sleep and/or sickness absence were also eliminated. Thus, the data of a total of 522 workers were analyzed. All participants worked a weekly counterclockwise in direction rotating three-shift system. Four job types—mechanics/repair workers, machine operators, manual laborers, and others—were evaluated (Table 1). The study was conducted with the informed consent of all the workers. The Ethical Committee of the Gifu University School of Medicine approved the study protocol and all aspects of the study adhered to the recommendations of the Journal for human biological rhythm research (Touitou et al., 2004).

Measurement Methods

Sleep Questionnaire: A self-administered sleep questionnaire was developed in our previous studies (Nakata et al., 2000, 2001); it included seven questions

Table 2. Questions regarding sleep habits as stated on questionnaire.

1.	On the average, how much sleep per day did you usually take during the last year? (1) less than 5 h (2) 6 h (3) 7 h (4) 8 h (5) 9 h (6) 10^{+} h
2.	How long does it usually take you to fall asleep in bed? (1) 0–10 min (2) 11–30 min (3) 31–59 min (4) 1–2 h (5) 2^{+} h
3.	How often do you have difficulty staying asleep? (1) never (or almost never) (2) few times a yr (3) more than once a month (4) more than once a week (5) almost every day
4.	How often do you wake up too early and can't fall asleep again? (1) never (or almost never) (2) few times a yr (3) more than once a month (4) more than once a week (5) almost every day
5.	Do you usually sleep well at night? (1) very well (2) fairly well (3) not so well (4) very poorly
6.	Do you think your daily sleep is sufficient? (1) very much sufficient (2) fairly sufficient (3) somewhat insufficient (4) definitely insufficient
7.	How often do you feel very drowsy when you are at work? (1) never (or almost never) (2) few times a yr (3) more than once a month (4) more than once a week (5) almost every day

regarding sleep during the previous 1-year period (Table 2). The first question addressed the daily hours of sleep. The second question addressed the difficulty initiating sleep (DIS), as defined by taking more than 30 min to fall asleep. Difficulty maintaining sleep (DMS) and early morning awakening (EMA) were defined by an answer of "almost every day" in response to the third and fourth questions. Sleeping poorly at night was defined by an answer of "not so well" or "very poorly" in response to the fifth question. Also, insufficiency of sleep was defined by an answer of "somewhat insufficient" or "definitely insufficient" in response to the sixth question. Excessive daytime sleepiness (EDS) at work was defined by an answer of "almost every day" in response to the seventh question.

Sickness Absence: The question to measure sickness absence was "How many days in total have you been absent from work due to sickness, including paid vacation, in the last 1-year period?" Due to the skewed distribution of days of sickness absence (0 to 30 days), subject responses were divided into three groups, consisting of no sickness absence (0 days, $n = 235$ subjects), 1 to 4 days (short-term, $n = 199$ subjects), and 5 days or more (long-term, $n = 88$ subjects).

Depressive Symptoms: Depressive symptoms were evaluated using the Center for Epidemiologic Studies Depression (CES-D) scale included in the Japanese version of the National Institute for Occupational Safety and Health (NIOSH) Generic Job Stress Questionnaire (GJSQ) (Haratani et al., 1996; Hurrell and McLaney, 1988; Nakata et al., 2004). The 20-item depressive symptom scale measures the level of depressive symptoms experienced the past week. The CES-D scale cut-off score of 16 differentiates the depressed from the nondepressed, but otherwise well, patient with both high sensitivity and specificity (Weissman et al., 1977).

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Job Stress Questionnaire: The Japanese version of the Job Content Questionnaire (JCQ) was used to assess job stress according to the job demand-control model and the demand-control-support model (Karasek, 1979), as previously described (Nakata et al., 2002). The questionnaires comprised 22 questions selected from the full recommended version (45 items) of the JCQ, and each reply was rated on a 4-point scale ranging from 1 to 4 (''strongly agree,'' ''agree,'' ''disagree,'' and ''strongly disagree''). These questions were categorized into three scales, i.e., ''psychological job demand,'' ''job control (decision latitude),'' and ''worksite social support'' (nine, five, and eight items, respectively). Psychological job demand evaluated quantity of work, intellectual requirements, and time constraints of the job. Job control evaluated the possibilities for making decisions, for being creative on the job, and for using and developing one's abilities. Social support at work evaluated support from supervisors and colleagues in the workplace. Data from our previous study (Kawakami and Fujigaki, 1996) showed the Japanese version of the JCQ has an acceptable level of reliability and validity. Specifically, Cronbach's alpha reliability coefficients for the scales ranged from 0.61 to 0.89 for males and from 0.65 to 0.87 for females; the scales showed factor-based validity, and age, and occupational distributions of the scale scores were as expected.

Other Covariates: Other covariates included age, marital status, years of education, smoking, alcohol consumption, caffeine intake (cups of coffee or tea/day), leisure time physical activity, overtime work (hours/month), and self-reported physical and/or psychological diseases and injuries (Table 1). Subjects were asked about the number of alcohol drinks they consumed per week, where one drink consisted of about 9 g of pure ethanol (grams of ethanol/week). Also, they were asked to report the number of cigarettes they usually smoked per day (number of cigarettes/day). A single question was used to assess the frequency of leisure time physical exercise each month during the previous year (times/month). The subjects were also asked about their history of physical and/or psychological diseases and injuries, such as hypertension, diabetes mellitus, hypercholesterolemia, heart disease, cancer, liver disease, renal disease, peptic ulcer, gastrointestinal diseases, neurological diseases, backache, musculoskeletal disorders, psychiatric illnesses, and accidents.

Statistical Methods

A series of individual univariate and multivariate logistic regression analyzes were done to identify any associations of sleep features and depressive symptoms with sickness absence. Adjusted variables were age group, marital status, years of education, diseases/injuries, smoking (continuous variable), alcohol consumption (continuous variable), caffeine intake (continuous variable), leisure time physical exercise, overtime work (continuous variable), and the three job stressors, i.e., job demands, job control, and social support at work (continuous variables). The significance level of all statistical analyses was $p < 0.05$ (two-tailed test). All data were analyzed by the Statistical Package for the Social Sciences version 10.0 (SPSS Inc., Chicago, USA).

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RESULTS

Prevalence of Poor Sleep: Analysis of the prevalence of sickness absence, subjective sleep features, and depressive symptoms is shown in the Table 3. The average sickness absence in the study sample was 2.3 days/yr. Some 16.9% of the workers had sickness absences of more than 5 days/yr. The average sleep length was 7 h, and the prevalence of DIS was 29.6%, DMS 15.5%, and EMA 3.4%. A total of 23.3% of the workers reported they slept very poorly and/or not so well at night, while 45.8% reported definite and/or somewhat insufficient sleep. The average CES-D scale score was 14.3, and the prevalence of depressive symptoms was 31.8% in the group of 522 shift workers.

Association of sleep features and depressive symptoms with sickness absence: Univariate logistic regression analyses showed workers with short-term sickness absence had a significantly higher prevalence of both DMS and EMA compared to ones with no sickness absence (Table 4). In the multivariate logistic regression analyses, EMA (OR = 5.3, 95%CI 1.3–22.0) remained significant.

When daily sleeping hours were excluded from the univariate analysis, five of six sleep variables and depressive symptoms were both significantly associated with long-term sickness absence (Table 4). All these sleep variables increased sickness absence two- to five-fold. With reference to these variables, DMS (OR = 2.1, 95%CI 1.0–4.6), EMA (OR = 5.6, 95%CI 1.0–28.7), sleeping poorly at night (OR = 2.6, 95%CI 1.4–5.0), and a high value for depressive symptoms (OR = 2.0, 95% C.I. 1.0–3.7) were significantly associated in the multivariate model.

Table 3. Sickness absences, subjective sleep habits, and depressive symptoms of 522 male shift workers of an electric equipment manufacturing company.

Variable	*N* (%)	Mean (SD, range)
Sickness absences (days/yr)		2.3 (3.7, 0–30)
No sickness absence (0 days)	235 (45.0)	
1–4 days	199 (38.1)	
5^+ days	88 (16.9)	
Subjective sleep habits during the previous 1-yr period:		
Average hours of daily sleep (h)		7.0 (1.0, 5–10)
Taking more than 30 min to fall asleep (DIS)	155 (29.6)	
Awakening during sleep almost every day (DMS)	81 (15.5)	
Early morning awakening almost every day (EMA)	18 (3.4)	
Sleeping poorly at night (very poorly/not so well)	121 (23.2)	
Insufficiency of sleep (definitely/somewhat)	239 (45.8)	
EDS at work almost every day	10 (1.9)	
Depressive symptoms (CES-D score)		14.3 (7.4, 1–49)
CES-D $\geq$ 16	166 (31.8)	

Note: SD = standard deviation; DIS = difficulty initiating sleep; DMS = difficulty maintaining sleep; EMA = early morning awakening; EDS = excessive daytime sleepiness; CES-D = Center for Epidemiologic Studies Depression scale.

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Table 4. Associations of sleep habits and depressive symptoms with sickness absences in 522 male shift workers in an electric equipment manufacturing company.

Variable Sleep habits	Criterion response	Sickness absence (days/year)[a] 1–4 days ($n=199$) Crude OR (95%CI)	1–4 days ($n=199$) Adjusted[b] OR (95%CI)	>5 days ($n=88$) Crude OR (95%CI)	>5 days ($n=88$) Adjusted[b] OR (95%CI)	p for trend
Time to fall asleep	Over 30 min (DIS)	1.3 (0.9–2.0)	1.4 (0.9–2.2)	1.7 (1.0–2.9)[d]	1.7 (1.0–3.2)	[d]
Awakening during sleep	Almost every day (DMS)	1.8 (1.0–3.1)[d]	1.7 (0.9–3.2)	2.3 (1.2–4.5)[e]	2.1 (1.0–4.6)[d]	[e]
Early morning awakening	Almost every day (EMA)	4.6 (1.3–16.8)[d]	5.3 (1.3–22.0)[d]	4.7 (1.1–20.0)[d]	5.6 (1.0–28.7)[d]	[d]
Sleeping well at night	Very poorly/not so well	1.5 (0.9–2.4)	1.5 (0.9–2.5)	2.4 (1.4–4.2)[e]	2.6 (1.4–5.0)[e]	[e]
Sufficiency of sleep	Definitely/somewhat insufficient	1.1 (0.7–1.6)	1.0 (0.6–1.5)	1.8 (1.1–3.0)[d]	1.6 (0.9–2.8)	n.s
EDS at work[c]	Almost every day	0.5 (0.1–2.5)	0.8 (0.1–7.2)	2.2 (0.6–8.2)	3.3 (0.4–28.7)	n.s
Depressive symptoms	CES-D ≥ 16	1.5 (1.0–2.3)	1.5 (0.9–2.4)	2.2 (1.3–3.7)[e]	2.0 (1.0–3.7)[d]	[e]

Note: OR = odds ratio; CI = confidence interval; DIS = difficulty initiating sleep; DMS = difficulty maintaining sleep; EMA = early morning awakening; EDS = excessive daytime sleepiness.

[a]Reference categories are "no (0 days/yr) sickness absence ($n=235$)."

[b]Adjusted in multiple logistic regression analyses for age group, marital status, education, diseases/injuries, smoking, alcohol consumption, caffeine intake, habitual exercise, overtime work, job control, job demands, and social support at workplace.

[c]For EDS at work, "hours of daily sleep" was also included as an adjusting factor in addition to [b]Adjusted in the multiple logistic regression analysis.

[d]$p < 0.05$.

[e]$p < 0.01$.

n.s = nonsignificant.

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DISCUSSION

This study shows that early morning awakening almost every day was significantly associated with both short- and long-term sickness absences of the studied shift workers. In addition, both difficulty maintaining sleep and sleeping poorly at night were associated with long-term sickness absence. This relationship was confirmed even after controlling for a broad range of confounding variables (Table 4). Depressive symptoms were also significantly associated with long- but not short-term, absence. The results revealed that poor sleep, particularly early morning awakening almost every day, seems to be a sensitive indicator of sickness absence compared to other sleep variables/habits or depressive symptoms.

In our study, early morning awakening almost every day and difficulty maintaining sleep, which may be considered as subtypes of insomnia, were associated with long-term sickness absences. The results are consistent with the findings of Leigh (1991) who compared insomnia to 36 other variables to show that insomnia was the second most common variable contributing to sickness absence in the previous 14-day period. Some of the 36 variables included demographics, health status, and job-related factors, with the first being a mother of a small child. Leigh (1991) also suggested that individuals with no reported sleep problems had roughly 1.4-fold fewer times absent days than persons who reported sleep trouble. Doi et al. (2003) estimated sleep quality of white-collar day workers during a 1-month period using the Pittsburgh Sleep Quality Index and found that workers with poor sleep quality, including insomnia symptoms and subtypes, show sickness absence with an OR of 1.89. The findings of our study, together with those of others, suggest that difficulty in maintaining sleep could be an important risk factor for sickness absence in day as well as shift workers.

While a significant relationship was found between sleeping poorly at night and long-term sickness absence, no significant relationship emerged between sufficiency of sleep and short- or long-term absences after controlling for multiple confounders. Subjective sleep quality might be a more sensitive indicator than sleep quantity for predicting sickness absence. Early morning awakening almost every day and compromised subjective sleep quality, such as sleeping poorly at night, might be markers of sickness.

Epidemiologic studies show that depression-related disorders and symptoms of depression, as well as poor mental health status, are associated with sickness absence (Savikko et al., 2001; Laitinen-Krispijn and Bijl, 2000; Stanfeld et al., 1995; Kopp et al., 1995). The results of the present study reveal that high levels of depressive symptoms, as defined by a CES-D scale score of $\geq$16, are significantly associated with long-term sickness absence. Kopp et al. (1995) found the severity of depression was significantly correlated with sickness absence in a population of 20,902 Hungarians. A Swedish study by Savikko et al. (2001) suggested that females with self-reported mental illness showed a 1.93-fold increase in sick-leave length over a 1-yr period compared to females without mental illness. Furthermore, a study by Laitinen-Krispijn and Bijl (2000) showed mental disorders, including major depressive disorder, dysthymia, simple phobia, and drug abuse/dependence, are predictive of sickness absence in men but not so much in women. Therefore, we suggest the persistence of depressive symptoms as measured by CES-D $\geq$16

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might be an important risk factor for long-term sickness absence in male shift workers. Treatment of symptoms may reduce the occurrence of long-term sickness absence.

Overall, the OR of sickness absence by depressive symptoms was lower than that of each insomnia symptom addressed here, as presented in Table 4. Great care should be taken in interpreting this finding. Given the cross-sectional nature of the current study, it is unclear as to the inter-relationship between insomnia symptoms, depressive symptoms, and sickness absence. Prospective data for a community sample aged 50 yrs or older have shown a predictive role of sleep complaints (trouble falling or staying asleep) in future depression, as assessed by DSM-12D (Roberts et al., 2000). But for the participants of the present study, of whom 32% had a CES-D score $\geq$16, symptoms reflecting insomnia seem to be factors more strongly associated with sickness absence than the depressive symptoms which include the symptoms of disturbed sleep (Q11 ''My sleep was restless'') on the CES-D.

No significant associations between excessive daytime sleepiness at work almost every day and either short- or long-term sickness absence were found. It has been reported that employees with severe daytime somnolence $\geq$3 days/week showed a 2-fold increase and employees with daytime somnolence of 1 to 2 days/week showed a 1.3-fold increase in sickness absence rates compared to those with no daytime somnolence during the preceding 1-year period (Philip et al., 2000). Our findings showed a lower short-term, but higher long-term, absence rate in workers with excessive daytime sleepiness at work, although it did not reach statistical significance. However, the differences in the demographics and study design of each of the two studies could account for the variance of findings. In our study, the subjects were younger (mean 27 yrs), mostly unmarried (63.6%), reported less disease (33.5%), and were all shift workers. Our study was also designed for cross-sectional sampling. The subjects of the Philip study were day workers who were older (mean age 51 yrs), and the study was prospective. The study was 37.1% females and most subjects had experienced diseases such as musculoskeletal disorders, cardiovascular disease, or neuro-psychiatric disorders during the previous 1 year.

Several limitations of the present study should be noted. First, the study design was cross-sectional, making it possible to identify only associations rather than causal relationships. Second, the sickness absences of this study were self-reported. Although certified sickness absence seems to be more reliable than self-reported absence, a previous report showed moderate to high association between self-reported and certified absences (Rees and Cooper, 1993). Third, the study subjects were limited to male workers of an electric equipment manufacturing company; thus, the findings of this study may not apply to female workers.

In summary, the present study showed that poor sleep features, such as early morning awakening, difficulty maintaining sleep, and poor night-time sleep, are related to sickness absence in male shift workers. The impact of the poor sleep on sickness absence was stronger than that of depressive symptoms. The results of this study suggest that workers with chronic sleep problems are more likely to take sickness absences, which may have implications for employee health, safety, and long-term business productivity.

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