Investigating the significance of three simple questions for identification of sleep problems

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ABSTRACT

Objectives. Thoroughly listening to complaints is important to properly diagnose sleep disorders. If sleep disorders can be identified using a few simple questions, more people can have earlier and appropriate treatments. Methods. The participants were Japanese workers who answered a medical questionnaire which included questions on lifestyle and work style, and the Pittsburgh Sleep Quality Index Japanese version (PSQI-J), in a periodic health checkup. The PSQI-J global score (PSQIG) was used to categorize participants into two groups. Lifestyles, including sleep conditions and work styles, between the groups were compared using the chi-square test. Logistic regression was used to calculate the odds ratios (ORs), adjusted for gender, age range, and work style, to measure associations between each sleep condition and the PSQIG group. Results. The subjects were 839 (men 714, women 125). In the “healthy sleep group (PSQIG ≤5)”, the numbers with a consistent sleep routine, good sleep quality, and an average of ≥6 hours of sleep were significantly higher. Women in the “healthy sleep group” were significantly more likely to be daytime-workers (p<0.01). The subjects in the “healthy sleep group” were more likely to have a consistent sleep routine (OR 1.61, 95% confidence interval 1.10–2.35), good sleep quality (5.53, 3.49–9.00), and an average of ≥6 hours sleep (3.04, 2.07–4.52). Conclusions. Three simple questions addressing sleep regularity, subjective sleep quality, and sleep duration were all associated with the PSQIG in this study. Asking a few questions about sleep might be useful to grasp the workers’ sleep conditions and to prevent them from developing sleep disorders.

Key words early diagnosis, questionnaire, sleep, sleep disorder, workplace

Introduction

Sleep disorders, such as insomnia and poorly perceived sleep quality, comprise approximately 20% of the Japanese population1-3. Workers are more likely to have sleep disorders due to work style4-6 and long working hours7, 8. Furthermore, many domestic and foreign research reports suggest that sleep disorders, such as insomnia or sleep apnea syndrome, raise the prevalence or morbidity risk of lifestyle-related diseases like high blood pressure, diabetes, or cerebrovascular disease, and deteriorate life prognosis8-13. In addition to the physical and mental conditions of workers, sleep disorders can lead to serious industrial accidents14. Research in Japan demonstrates that very few people are treated appropriately for sleep disorders2.

Thoroughly listening to complaints is important to properly diagnose sleep disorders. Therefore, there are many questions in the questionnaires to measure sleep conditions. For example, the Pittsburgh Sleep Quality Index (PSQI)15, 16, used by epidemiological researchers or clinicians, frequently consists of 18 questions.

The Industrial Safety and Health Act17 in Japan states that all workers shall undergo a periodic health checkup, which makes it possible to ascertain the health condition of workers. In the health checkup, there are many questions, not only about sleep, but also subjective symptoms, current and past medical history, family history, work style, lifestyle, and so on18. All workers in Japan meet a doctor in the health checkup at least once a year17; however, the time for a medical consultation by a doctor is limited. If doctors can find a sign of disease with a few medical questions in a short time, the questions might be useful to grasp the workers’ sleep conditions and to prevent them from developing sleep disorders. If sleep disorders can be identified by a few questions about sleep at a health checkup, more people can have earlier and appropriate treatment. However, there are few reports that sleep disorders can be identified by a few questions. This study examined the significance of three simple sleep-related questions in a health checkup in the workplace to assist in identifying sleep disorders.
Subjects and Methods

Procedures and participants
Participants were workers from a certain railway company in Japan who underwent a periodic health checkup from September 7th to 25th, 2015 and agreed to participate in the study. Participants answered three simple questions related to sleep, PSQI Japanese version (PSQI-J)16), and a medical questionnaire.

Measures
The following three simple sleep questions consist of sleep regularity, quality, and duration: “Is your sleep routine consistent? (Yes or No)”, “Is your sleep good? (Yes or No)”, and “How long do you sleep per day? (<6 hours or ≥6 hours)”.

The medical questionnaire included questions about lifestyle (smoking and alcohol) and work style.

PSQI-J is a standardized self-administered questionnaire to assess subjective sleep quality over the past one month, consists of seven components scores (0-3) of sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, hypnotic medication use, and daytime dysfunction, and yields a global score (0-21). A global PSQI score (PSQIG) >5 represents that the person has some sleep problems15.19). Participants were divided into either “healthy sleep group (PSQIG ≤5)” or “non-healthy sleep group (PSQIG >5)”. Statistical analysis
Participants in each group were stratified by age group (all ages, ≤29 years old (yo), 30–49 yo, and ≥50 yo) and gender. The ratio of non-smokers, non-drinkers, daytime-workers, a consistent sleep routine, good sleep quality, and an average of ≥6 hours of sleep was calculated, and a chi-square test was performed to compare the PSQIG groups (“healthy sleep group” and “non-healthy sleep group”). We investigated the association between the responses to three simple questions measured in this study and the PSQIG groups. The “non-healthy sleep group” was used as baseline and odds ratios (ORs) for the responses to each question (a consistent sleep routine, good sleep quality, or an average of ≥6 hours sleep) using logistic regression adjusted for gender, age range, and work style. JMP® Pro 11 was used to conduct statistical analyses, and the statistical significance was set at p<0.05 (two-sided).

Ethical considerations
This study was conducted according to the Ethical Guidelines for Epidemiological Studies30) established by the Japanese government, and the research protocol (No.2016126) was approved by the Ethics Committee of Juntendo University. We obtained informed consent from all participants.

Results
1. Basic characteristics of study participants
There were 972 participants (835 men, 137 women). We analyzed data from 839 participants (86.3%), who completed all of the PSQI-J. The subjects were 714 men (85.1%). The mean age was 38.5 yo (range 19.0–68.0). The mean PSQIG in the subjects was 5.3 (range 0.0–15.0). The subjects were split into either the “healthy sleep group” (n=492; 58.6%) or the “non-healthy sleep group” (n=447; 54.1%) (Table 1).

The number of subjects in each age group (≤29 yo, 30–49 yo, and ≥50 yo) was 296 (men 215, women 81), 293 (men 252, women 41), and 250 (men 247, women 3), respectively (Table 1). The group of women aged ≥50 years was not analyzed due to the sample size. Table 1 summarizes the medical questionnaire responses, the mean PSQIG, and the number of subjects in the “healthy sleep group” by age group.

2. Comparison of the medical questionnaire responses between the “healthy sleep group” and the “non-healthy sleep group”
Table 2-1 and Table 2-2 summarize the comparison of the responses to the medical questionnaire consisting of 3 questions about sleep, Lifestyle (smoking and alcohol) and working form between the “healthy sleep group” and the “non-healthy sleep group”.

Significantly more subjects reported a consistent sleep routine and good sleep quality in all age groups within the “healthy sleep group” compared to the “non-healthy sleep group”, except for women aged 30–49 years. The subjects in the “healthy sleep group” were more likely to report an average of ≥6 hours of sleep compared with the “non-healthy sleep group”, except in the women aged ≤29. Women in the “healthy sleep group” were more likely to be daytime-workers. There were no significant differences in the smoking status in either group. The women of all ages or those aged ≤29 in the “healthy sleep group” were less likely to be non-smokers.
Table 2-1  Comparison of responses to three simple questions about sleep and lifestyle factors by study participants assigned to the “health sleep group” or “non-healthy sleep group” by male participants from a Japanese railway company undergoing a periodic health checkup.

|                      | healthy sleep group | non-healthy sleep group | p-value* |
|----------------------|---------------------|-------------------------|----------|
|                      | n (%)               | n (%)                   |          |
| men (n=714)          |                     |                         |          |
|                      |                     |                         |          |
| consistent sleep routine |                     |                         |          |
| all ages             | 262 (61.2%)         | 110 (38.5%)             | <0.01    |
| ≤29 yo               | 57 (50.4%)          | 26 (25.5%)              | <0.01    |
| 30–49 yo             | 98 (57.0%)          | 34 (42.5%)              | 0.032    |
| ≥50 yo               | 107 (74.8%)         | 50 (48.1%)              | <0.01    |
| good sleep quality   |                     |                         |          |
| all ages             | 405 (94.6%)         | 187 (65.4%)             | <0.01    |
| ≤29 yo               | 113 (100%)          | 72 (70.6%)              | <0.01    |
| 30–49 yo             | 161 (93.6%)         | 57 (71.3%)              | <0.01    |
| ≥50 yo               | 131 (91.6%)         | 59 (55.8%)              | <0.01    |
| an average of ≥6 hours of sleep |                   |                         |          |
| all ages             | 383 (89.5%)         | 179 (62.6%)             | <0.01    |
| ≤29 yo               | 100 (88.5%)         | 62 (60.8%)              | <0.01    |
| 30–49 yo             | 157 (91.5%)         | 52 (65.0%)              | <0.01    |
| ≥50 yo               | 126 (88.1%)         | 65 (62.5%)              | <0.01    |
| non-smoker           |                     |                         |          |
| all ages             | 261 (61.0%)         | 166 (58.0%)             | 0.432    |
| ≤29 yo               | 65 (57.5%)          | 53 (52.0%)              | 0.413    |
| 30–49 yo             | 98 (57.0%)          | 54 (67.5%)              | 0.112    |
| ≥50 yo               | 98 (68.5%)          | 59 (56.7%)              | 0.057    |
| non-drinker          |                     |                         |          |
| all ages             | 179 (41.8%)         | 131 (45.8%)             | 0.293    |
| ≤29 yo               | 58 (51.3%)          | 55 (53.9%)              | 0.704    |
| 30–49 yo             | 76 (44.2%)          | 40 (50.0%)              | 0.389    |
| ≥50 yo               | 45 (31.5%)          | 36 (34.6%)              | 0.603    |
| daytime-worker       |                     |                         |          |
| all ages             | 140 (32.7%)         | 74 (25.9%)              | 0.051    |
| ≤29 yo               | 13 (11.5%)          | 7 (6.9%)                | 0.242    |
| 30–49 yo             | 54 (31.4%)          | 27 (33.8%)              | 0.709    |
| ≥50 yo               | 73 (51.0%)          | 40 (38.5%)              | 0.050    |

* “Healthy sleep group”: Pittsburgh Sleep Quality Index Global Score (PSQIG) ≤5.
** “Non-healthy sleep group”: PSQIG >5.
† Chi-square test. Statistical significance defined as p < 0.05

Table 2-2  Comparison of responses to three simple questions about sleep and lifestyle factors by study participants assigned to the “health sleep group” or “non-healthy sleep group” by female participants from a Japanese railway company undergoing a periodic health checkup.

|                      | healthy sleep group | non-healthy sleep group | p-value†† |
|----------------------|---------------------|-------------------------|----------|
|                      | n (%)               | n (%)                   |          |
| women (n=125)        |                     |                         |          |
|                      |                     |                         |          |
| consistent sleep routine |                     |                         |          |
| all ages             | 43 (67.2%)          | 22 (36.1%)              | <0.01    |
| ≤29 yo               | 24 (66.7%)          | 13 (28.9%)              | 0.001    |
| 30–49 yo             | 18 (66.7%)          | 7 (50.0%)               | 0.300    |
| ≥50 yo               |                      |                        |          |
| good sleep quality   |                     |                         |          |
| all ages             | 58 (90.6%)          | 39 (63.9%)              | <0.01    |
| ≤29 yo               | 34 (94.4%)          | 27 (60.0%)              | <0.01    |
| 30–49 yo             | 23 (85.2%)          | 10 (71.4%)              | 0.292    |
| ≥50 yo               |                      |                        |          |
| an average of ≥6 hours of sleep |                |                         |          |
| all ages             | 55 (85.9%)          | 42 (68.9%)              | 0.022    |
| ≤29 yo               | 32 (88.9%)          | 33 (73.3%)              | 0.081    |
| 30–49 yo             | 22 (81.5%)          | 7 (50.0%)               | 0.036    |
| ≥50 yo               |                      |                        |          |
| non-smoker           |                     |                         |          |
| all ages             | 63 (98.4%)          | 57 (93.4%)              | 0.154    |
| ≤29 yo               | 35 (97.2%)          | 42 (93.3%)              | 0.422    |
| 30–49 yo             | 27 (100%)           | 13 (92.9%)              | 0.160    |
| ≥50 yo               |                      |                        |          |
| non-drinker          |                     |                         |          |
| all ages             | 37 (57.8%)          | 48 (78.7%)              | 0.012    |
| ≤29 yo               | 18 (50.0%)          | 38 (84.4%)              | 0.001    |
| 30–49 yo             | 18 (66.7%)          | 8 (57.1%)               | 0.548    |
| ≥50 yo               |                      |                        |          |
| daytime-worker       |                     |                         |          |
| all ages             | 37 (57.8%)          | 16 (26.2%)              | <0.01    |
| ≤29 yo               | 18 (50.0%)          | 10 (22.2%)              | 0.009    |
| 30–49 yo             | 18 (66.7%)          | 4 (28.6%)               | 0.020    |
| ≥50 yo               |                      |                        |          |

* “Healthy sleep group”: Pittsburgh Sleep Quality Index Global Score (PSQIG) ≤5.
** “Non-healthy sleep group”: PSQIG >5.
† Chi-square test. Statistical significance defined as p < 0.05

Table 3  Associations between three simple questions about sleep and the “healthy sleep group” or the “non-healthy sleep group” designated using Pittsburgh Sleep Quality Index Global Score (PSQIG) of study participants (n=839) from a Japanese railway company undergoing a periodic health checkup.

|                              | PSQIG ≤5 (%) | OR (95% CI) | p-value |
|------------------------------|--------------|-------------|---------|
| consistent sleep routine     | 305 (62.0%)  | 1.61 (1.10–2.35) | 0.014  |
| good sleep quality           | 463 (94.1%)  | 5.53 (3.49–9.00) | <0.0001|
| an average of ≥6 hours of sleep | 438 (89.0%)  | 3.04 (2.07–4.52) | <0.0001|

* Pittsburgh Sleep Quality Index Global Score
* Odds ratio adjusted for gender, age group, and work style. The “non-healthy sleep group” was used as a baseline for logistic regression.

3. Association between three simple sleep questions and PSQIG

Table 3 shows that the adjusted ORs of subjects assigned to the “healthy sleep group” who reported a consistent sleep routine, good sleep quality, and an average of ≥6 hours sleep were 1.61 (95% CI: 1.10–2.35), 5.53 (95% CI: 3.49–9.00), and 3.04 (95% CI: 2.07–4.52), respectively, compared to the “non-healthy sleep group”. In this logistic regression, the coefficient of determination (R²) was 0.1594.
Discussion

Three simple questions about sleep regularity, quality, and duration, used in a certain railway company’s periodic health checkup, were significantly associated with PSQIG respectively in this study. The question of sleep quality had the strongest association with PSQIG. The result indicated that persons who feel they have a good quality of sleep are more likely to belong to the “healthy sleep group”. In this study, 82.1% of the participants, who completed the medical questionnaire, answered that they had good sleep quality, which is consistent with the previous studies. A previous study also found a strong correlation between PSQIG and subjective sleep quality which was one of the components of PSQI. A person’s perceived feeling of sleep quality might be important in diagnosing sleep disorders.

Additionally, people who do not get an adequate amount of sleep (≥5 hours or >6 hours) are at an increased risk of morbidity and mortality. According to the Sleep Guideline for Health Promotion 2014 in Japan, 6–8 hours of sleep reduces the risk of lifestyle-related diseases and depression. In this study, workers with an average of ≥6 hours of sleep were significantly more likely to be in the “healthy sleep group”. Our finding seems to coincide with the previous studies indicating that workers with an inconsistent sleep routine are more likely to develop sleep disorders. The finding coincides with the previous studies indicating that workers with an inconsistent sleep routine are more likely to develop sleep disorders.

This study has several limitations. Since all of the participants were workers from one company, this study may not be generalizable to other companies or the general population. Work situations and lifestyle can impact sleep disorders, and workers tend to be healthier than the general population (the healthy worker effect). In this logistic regression adjusted for gender, age range, and work style, the coefficient of determination is small. Additionally, other methods to evaluate sleep disorders exist, but we only compared our method with the PSQI-J. Further studies are required to evaluate the reliability, validity, and generalizability of these three simple sleep questions.

In fact, out of the three questions, at least two of them, sleep quality and duration, are part of the questions of the PSQI, the components of PSQI. A person’s perceived feeling of sleep quality might be important in diagnosing sleep disorders. Workers with consistent sleep routine are less likely to have sleep disorders. The finding coincides with the previous studies indicating that workers with an inconsistent sleep routine are more likely to develop sleep disorders.

Our results indicated that workers who had a consistent sleep routine were more likely to be in the “healthy sleep group” suggesting that sleep regularity is associated with sleep quality. Workers with consistent sleep routine are less likely to have sleep disorders. The finding coincides with the previous studies indicating that workers with an inconsistent sleep routine are more likely to develop sleep disorders.

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