A study of the impact of occupational and domestic factors on insomnia among industrial workers of a manufacturing company in Japan

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Insomnia is one of the most common health problems and has recently been re-termed 'Disorders of Initiating and Maintaining Sleep', or DIMS. The main purpose of the present study was to investigate the relationship between daily psychosocial stressors, to which workers are exposed in occupational and/or private life, and insomnia among male industrial workers in a medium-sized company located in Nagasaki City, Japan. All of the workers in the company (n = 368, male = 319) were asked to answer six sleep related questions and 24 questions about working and private conditions. Two hundred and seventy-one (85.0%) of them completed the questionnaire (average age was 40.9 years old). Twenty seven point seven per cent of the subjects complained of insomnia in the last month prior to the survey and the prevalence was in general accord with previous surveys. On the other hand, the proportion of hypnotic use (1.1%), especially in insomniac group (2.7%) was lower than previous reports. The results of multiple logistic regression analysis demonstrated that four psychosocial factors were significantly associated with insomnia: i.e. VDT work overload (odds ratio [OR] 5.058; 95% confidence intervals [95% CI] 2.381-10.745), limited space of bedroom (OR 2.612; 95% CI 1.283-5.683), over-involvement in job (OR 2.78; 95% CI 1.188-6.540), frequent alcohol beverages consumption (OR 2.595; 95% CI 1.177-5.719).

Key words: Insomnia; psychosocial stressors; questionnaire; sleep disorders; worker

INTRODUCTION

Sleep disturbances can be either the cause or the consequence of psychological stress and can be found in close association as secondary reactions to more serious medical problems. Sleep disturbances may be considered as a simple and useful health indicator. As described above, sleep disturbances are supposed to reflect our physical and/or psychological conditions.

Of the various sleep disturbances, insomnia is known to be the most common and the prevalence in previous reports have greatly varied from 1.4%/1.7% (male/female) in Sweden to 48% in France. Poor sleep can impair daytime functioning and affect directly quality of life. To treat, manage and prevent insomnia, and to promote sleep effectively, it is necessary to realize the causes of insomnia properly and to make an effort to remove them. However, investigations on self-reported sleep quality have been mainly conducted in the general or elderly population and those in industrial workers are scarce, except several studies on shift workers' sleep. In the present study based on self-reported sleep quality of industrial work-
Table 1. Demographic characteristics of the male workers

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n = 271</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years*)</td>
<td>40.9 ± 11.4</td>
</tr>
<tr>
<td>Employed (years*)</td>
<td>17.9 ± 9.8</td>
</tr>
<tr>
<td>Work/week (hours*)</td>
<td>48.8 ± 8.8</td>
</tr>
<tr>
<td>Work schedule</td>
<td>Permanent day shift</td>
</tr>
<tr>
<td>Family members (persons*)</td>
<td>3.6 ± 1.3</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>18.8</td>
</tr>
<tr>
<td>Married</td>
<td>81.2</td>
</tr>
<tr>
<td>Job type (%)</td>
<td></td>
</tr>
<tr>
<td>Engineers</td>
<td>58.3</td>
</tr>
<tr>
<td>Managerial staff of engineers</td>
<td>16.2</td>
</tr>
<tr>
<td>Clerical staff</td>
<td>10.0</td>
</tr>
<tr>
<td>Others</td>
<td>15.5</td>
</tr>
<tr>
<td>Job class (%)</td>
<td></td>
</tr>
<tr>
<td>Head director</td>
<td>1.8</td>
</tr>
<tr>
<td>Section chief</td>
<td>17.3</td>
</tr>
<tr>
<td>Chief clerk</td>
<td>14.3</td>
</tr>
<tr>
<td>Mere clerk</td>
<td>66.6</td>
</tr>
<tr>
<td>Sleep time (hours)</td>
<td></td>
</tr>
<tr>
<td>&lt; 4</td>
<td>1.8</td>
</tr>
<tr>
<td>4–6</td>
<td>44.3</td>
</tr>
<tr>
<td>6–8</td>
<td>50.6</td>
</tr>
<tr>
<td>&gt; 8</td>
<td>3.3</td>
</tr>
</tbody>
</table>

* Mean ± SD
† Working hours including overtime work

ers, we discussed insomnia caused by tension, anxiety, worry and/or depression. Moreover those emotional factors were supposed to be closely associated with current psychosocial stress level, namely daily occupational and private stressors. The main purpose of this study which was conducted on industrial workers in Nagasaki City, Japan is to investigate the relationship between insomnia and psychosocial factors, to which most industrial workers are exposed in their daily occupational life at the workplace and their private life at home.

SUBJECTS AND METHODS

The subjects in the present study were 368 industrial workers from a manufacturing company located in Nagasaki City in the Western part of Japan; 319 (86.7%) were male and 49 (13.3%) were female. All of the subjects were permanent day workers, aged between 18–64 years old with a mean age of 40.6 ± 11.7 years in the males and 31.8 ± 11.9 years in the females respectively (Mean ± SD). The company is a subsidiary of a major heavy industry group and its main business is developing FA (factory automation) machinery and designing construction plans.

In October 1992, all of the workers in the company were asked to answer the questionnaire anonymously, which consisted of six items concerning sleep problems and 24 items concerning working and private life conditions, and the Self-rating Depression Scale, SDS. On answering each question, the subjects were expected to select the most adequate choice from four possible answers; 'never,' 'seldom,' 'often' and 'always,' or to answer 'yes,' or 'no.' The response rate was 85.0% in males and 69.4% in females. As the term 'insomnia' has been replaced by the term 'Disorders of Initiating and Maintaining Sleep' (DIM), in the present study we defined the insomniac group as those who were troubled by any of the following sleep problems in the month prior to the survey; i.e. 'difficulty falling asleep', 'midsleep awakenings', and 'early morning awakening.' Because female subjects were small in number and greatly differed from male subjects in age distribution, job type, job class and response rate, only the data of the 271 males, aged 18–64 years (40.9 ± 11.4 years), were used in further analyses. The types of subjects' job under analyses were as follows; 58.3% (158/271) engineers developing FA machinery and designing construction work, 16.2% (44/271) managerial staffs of the engineers, 10.0% (27/271) clerical staffs and 15.5% (42/271) others. Most of the subjects graduated from university or technical college. No differences were found among job types in demographic characteristics such as age, work-shift and working hours.

Statistical methods

In comparing the prevalence of insomnia among age groups, the Cochran–Armitage $\chi^2$ test was used to test for a linear trend. To evaluate the relationship between insomnia and various psychosocial factors comprehensively, multiple logistic regression analysis was employed. The results were considered statistically significant at $p < 0.05$. The statistical analyses were all performed by means of the Statistical Analysis System (SAS).

RESULTS

Prevalence of insomnia

According to the definition of insomnia in this study, seventy-five male workers (27.7%) were classified into an insomniac group (Table 2). Judging from age distribution of insomnia, the prevalence increased significantly ($p < 0.001$) with aging: it was highest in the 50–64 year-old group (42.3%) and lowest in the under 30 year-old group (13.5%). Among the three types of insomnia, the prevalence of midsleep awakenings was highest (15.9%) and early morning awakening (13.3%) ranked second, followed by difficulty falling asleep (10.0%). Aging was significantly associated both with frequent midsleep awakenings and early morning awakening. No significant difference was observed in difficulty falling asleep among age groups. In addition, no significant difference was found in the prevalence of insomnia among job types (data not shown).
The females’ low response rate (female 69.4% vs. male 85.0%) is considered to be due to the SDS (Self-rating Depression Scale)\(^{15}\) with sleep questionnaire distribution never/seldom; excessive outside noise at night? Often/always vs. never/seldom; 'coffee or tea consumption in the evenings and at night' (Are you bothered by environmental noises at night' (Are you anxious about your duties after working hours and/or during day-off? Often/always vs. never/seldom; 'frequent alcohol beverages consumption' (How many times do you take alcohol beverages per week? Four days or more vs. three days or less; p < 0.05) were significantly associated with insomnia. The other 19 factors included in the model were not significantly related to insomnia; e.g. 'coffee or tea consumption in the evenings and at night' (How many cups of coffee or tea do you take in the evenings and at night? Three cups or more vs. two cups or less; p < 0.07) and 'environmental noises at night' (Are you bothered by excessive outside noise at night? Often/always vs. never/seldom; p < 0.07). (Table 4).

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**RESULTS OF MULTIPLE LOGISTIC REGRESSION ANALYSIS**

To investigate the relationship between occupational and private factors and insomnia comprehensively, multiple logistic regression analysis was conducted on the basis of 23 psychosocial factors using 235 valid responses without missing data from the 271 responses received from the male workers. All the factors concerning working and domestic conditions were included in the analysis. Ninety-five per cent confidence intervals (95% CI) were calculated for the odds ratio derived from multiple logistic regression model. The results demonstrated that four factors; i.e. 'VDT work overload' (Is there too much VDT work? Often/Always vs. Never/Seldom; p < 0.001); 'limited space of bedroom' (Do you feel your bedroom is too small? Yes vs. No; p < 0.01); 'over-involvement in job' (Are you anxious about your duties after working hours and/or during day-off? Often/always vs. never/seldom; p < 0.05), and 'frequent alcohol beverages consumption' (How many times do you take alcohol beverages per week? Four days or more vs. three days or less; p < 0.05) were significantly associated with insomnia. The other 19 factors included in the model were not significantly related to insomnia; e.g. 'coffee or tea consumption in the evenings and at night' (How many cups of coffee or tea do you take in the evenings and at night? Three cups or more vs. two cups or less; p < 0.07) and 'environmental noises at night' (Are you bothered by excessive outside noise at night? Often/always vs. never/seldom; p < 0.07). (Table 4).

**FREQUENCY OF THE USE OF HYPNOTICS**

Of all the subjects, only 11 males (4.1%) reported the current or past use of hypnotics. There were no subjects who frequently used hypnotics. Even in the insomniac group, the current and past use of hypnotics were only 2.7% and 6.7% respectively. The insomniac group reported significantly (p < 0.05) higher proportions of hypnotic use than the normal sleep group (Table 3).

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Table 4. Relations of psychosocial factors to insomnia by multiple logistic regression analysis (no. of subjects included in analysis = 235)

<table>
<thead>
<tr>
<th>Psychosocial factors</th>
<th>Odds Ratio*</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (over 40 vs. under 40)</td>
<td>1.072</td>
<td>(0.423-2.715)</td>
</tr>
<tr>
<td>Marital status (single vs. married)</td>
<td>1.360</td>
<td>(0.340-5.434)</td>
</tr>
<tr>
<td>Job class (managerial vs. general)</td>
<td>0.626</td>
<td>(0.254-1.542)</td>
</tr>
<tr>
<td>Tea or coffee consumption after supper (three cups or more vs. two cups or less)</td>
<td>2.125</td>
<td>(0.971-4.660)</td>
</tr>
<tr>
<td>Alcohol beverages consumption per week (four days or more vs. three days or less)</td>
<td>2.595</td>
<td>(1.177-5.719)*</td>
</tr>
<tr>
<td>Feeling job is worthwhile (never/seldom vs. often/always)</td>
<td>2.070</td>
<td>(0.760-5.637)</td>
</tr>
<tr>
<td>Dissatisfaction with present treatment in workplace (often/always vs. never/seldom)</td>
<td>1.338</td>
<td>(0.625-2.866)</td>
</tr>
<tr>
<td>Job overload (often/always vs. never/seldom)</td>
<td>1.980</td>
<td>(0.402-2.093)</td>
</tr>
<tr>
<td>Job suitability (no vs. yes)</td>
<td>0.918</td>
<td>(0.402-2.093)</td>
</tr>
<tr>
<td>VDT work overload (often/always vs. never/seldom)</td>
<td>5.058</td>
<td>(2.381-10.749)**</td>
</tr>
<tr>
<td>Trouble with human relations in workplace (often/always vs. never/seldom)</td>
<td>1.334</td>
<td>(0.587-3.032)</td>
</tr>
<tr>
<td>Social support in workplace (no vs. yes)</td>
<td>1.181</td>
<td>(0.416-3.349)</td>
</tr>
<tr>
<td>Invasion of privacy by job (often/always vs. never/seldom)</td>
<td>0.880</td>
<td>(0.368-2.101)</td>
</tr>
<tr>
<td>Ovarian involvement in job (often/always vs. never/seldom)</td>
<td>2.787</td>
<td>(1.186-6.540)*</td>
</tr>
<tr>
<td>Wishes to change of occupation (yes vs. no)</td>
<td>1.141</td>
<td>(0.440-2.957)</td>
</tr>
<tr>
<td>Physical condition (bad vs. good)</td>
<td>1.707</td>
<td>(0.763-3.618)</td>
</tr>
<tr>
<td>Physical condition of family members (bad vs. good)</td>
<td>1.000</td>
<td>(0.448-2.235)</td>
</tr>
<tr>
<td>Socioeconomic dissatisfaction (yes vs. no)</td>
<td>1.113</td>
<td>(0.530-2.336)</td>
</tr>
<tr>
<td>Pleasure of a happy home (never/seldom vs. often/always)</td>
<td>0.838</td>
<td>(0.316-2.233)</td>
</tr>
<tr>
<td>Domestic troubles (yes vs. no)</td>
<td>1.627</td>
<td>(0.512-5.168)</td>
</tr>
<tr>
<td>Recreation for a change (never/seldom vs. often/always)</td>
<td>0.652</td>
<td>(0.261-1.626)</td>
</tr>
<tr>
<td>Limited space of bedroom (yes vs. no)</td>
<td>2.612</td>
<td>(1.283-5.638)**</td>
</tr>
<tr>
<td>Environmental noise at night (often/always vs. never/seldom)</td>
<td>2.100</td>
<td>(0.978-4.509)</td>
</tr>
</tbody>
</table>

*Odds ratio for insomnia of the former group compared to the latter group in parenthesis.

\[ p < 0.05; \quad \ast p < 0.01; \quad \ast \ast p < 0.001 \]

falling asleep (10.0%) came last. Frequent midsleep awakenings and early morning awakening are found more frequently among older (≥ 40) workers than younger (≤ 39). This is in agreement with the previous studies in which it was confirmed that sleep becomes shortened and less consolidated with aging both through EEG (electroencephalogram) analysis and epidemiological survey. Compared to previous studies, the proportion of hypnotic use (1.1%), especially in the insomniac group (2.7%) seems to be fairly low (Table 3). The proportion of hypnotic use found in general populations has been reported to range from 1.5% to 11.8%. Eight point eight per cent to 39% were found in the insomniac group. It was reported that the higher the workers' educational level, the lower the prevalence of the use of sleeping tablets. Salva et al. also suggested that education might include greater exposure to publications emphasizing the risks of hypnotic intake. Furthermore, in Japan, there is a widespread opinion that hypnotics are unsafe and quite addictive. The low proportion of hypnotic use in this study may be ascribable to the high level of education of the subjects.

To investigate the relationship between insomnia and various psychosocial factors, a multiple logistic regression analysis was adopted. Considering the possibility of multicollinearity, correlation coefficients between various psychosocial variables were calculated. The results of calculations revealed that strong correlations existed between age and job class, between age and marital status. Most of other correlation coefficients were found to be between -0.200 and 0.200 with the exception of two coefficients: i.e. between 'Job suitability' and 'Wishes to change of occupation' and 'Domestic troubles' and 'Pleasure of a happy home'.

The results of the multiple logistic regression (Table 4) suggested that frequent (four days or more per week) consumption of alcohol beverages was significantly associated with insomnia. On the effects of alcohol ingestion during sleep, Roth et al. reported that the long-term use of alcohol could induce insomnia. Prinz et al. in their review noted that even self-medication with alcohol as an aid to sleep could result in disturbed sleep. It is well known that acute alcohol ingestion shortens the sleep latency, but chronic alcohol ingestion increases the amount of wakefulness. In addition, Rouhani et al. reported that even
a single low dose of alcohol increased sleep fragmentation and the number and duration of awakenings on polygraphic recordings. In Japan, while hypnotic use is regarded more dangerous than it really is, the deleterious effects of casual drinking are overlooked. It seems necessary for us to make appropriate pharmacological information on either hypnotics or alcohol beverages widely known to the public.

The occupational factors which showed significant association with insomnia through multiple logistic regression analysis were 'VDT work overload' and 'Over-involvement in job.'

As in other developed countries, the working environments in Japan have changed rapidly owing to technological advances, especially computerization since the early 1980's. VDT work overload was surmised to reflect the rapid change of working environments. Many investigators have reported that rapidly increasing use of VDT in workplaces caused the elevation of various psychological stress levels. According to several reports, VDT workers have been suffering from psychological distresses such as depression, computer anxiety and psychogenic fugue. Smith indicated that the computer technology per se was not the source of job stress, however it might produce job conditions that are stressful by changing the nature of work through productive improvements in its applications. Watanabe et al. also reported that the main cause of the techn anxious condition was the lack of computer training. In addition, they pointed out that longer daily VDT hours were associated with stress-related symptoms. Considering the above-mentioned reports, it seems difficult to conclude that VDT work leads to insomnia directly. However it appears quite probable that workers suffering from VDT related psychological distress complain of insomnia as one of their psychosomatic symptoms induced by stressful job conditions. In any case, as with many of the VDT-related health problems including insomnia, more fundamental research into the mechanisms of disturbance is needed.

'Over-involvement in job' could be regarded as a manifestation of psychological overload. Salord et al. reported that psychological workload was linked to sleep disturbance, while the latter was not associated with physical workload. Urponen et al. reported that men considered work-related pressure as the most important factor disturbing sleep; e.g. work immediately before bedtime, mental work and unfinished work. These findings agree with the present results.

The most striking finding of the present study was that 'limited space of bedroom' was significantly related to insomnia (Table 4). There are many reports on the effects of housing conditions on the physical and/or psychological health status of residents. Especially from the viewpoint of floor space per person, it has been reported that small amounts of space per person exert harmful effects on mental health. We also found that workers who felt that their bedroom was too small scored significantly ($p < 0.001$) higher on SDS than the others (data not shown). In this study, narrow bedroom space might be perceived by workers to be a sleep disturbing factor. However this relationship may be the reverse. Whether the feeling that the bedroom is too narrow is causal or reflects poor mental condition induced by insomnia remains to be clarified.

In conclusion, as occupational physicians are often involved in the management of insomnia related to work, they have to make efforts to understand the nature of workloads, such as VDT operation, and the workers' lifestyle such as drinking. If necessary and/or applicable, they should provide the proper information on hypnotic use for insomniacs. To manage and prevent insomnia in the practice of occupational medicine, occupational physicians and other occupational health personnel are required to understand the nature of insomnia as well as workload and to promote health education including advice on lifestyle. From the viewpoint of improving quality of life, to eliminate insomnia only is meaningful enough. In addition, many investigators pointed out the high comorbidity of insomnia with psychiatric disorders such as depression and anxiety disorders. Ford et al. stated that as both patients and physicians could discuss sleep disturbances more easily than other psychiatric symptoms, it might be a useful opportunity for the prevention of new psychiatric disorders. Work site physicians and other occupational health personnel should keep in mind that inquiry about insomnia could be regarded as a positive opportunity for early treatment intervention in psychiatric disorders and promotion of mental health.

There are, it should be admitted, several limitations in this study; e.g. the number of selected workers was not sufficient and only males were discussed. As the data was collected in a single company, the results to a certain degree depend on the characteristics of the particular company. Above all, the most important limitation is cross-sectional study design and therefore, we could elucidate only association but not causal relationships. To make our findings more reliable and universal, it would be necessary not only to expand the study to a larger worker population but also to adopt a follow-up study design. The present study therefore should be considered as a preliminary step toward further research to identify the causal relationship between insomnia and psychosocial stressors among modern industrial workers.

**REFERENCES**

APPENDIX

Questionnaire

Working and Social Environment

1. What is your age ____ years and sex: Male □ Female ○
   Marital Status: Single □ Married ○ Widowed ○

2. What is your position in the company? ________________________________

3. How many cups of coffee or tea do you drink in the evenings and at night? Three cups or more □ Two cups or less ○
4. How many times per week do you drink alcoholic beverages? Four days or more □ Three days or less ○
5. Do you feel that your job is worth engaging in? Always □ Often ○ Seldom ○ Never ○
6. Are you satisfied with the company's assessment of your services? Always □ Often o Seldom ○ Never ○
7. Do you think you work too much? Always □ Often ○ Seldom ○ Never ○
8. Do you think you have an aptitude for your work? Yes □ No ○
9. Is there too much VDT at your work environment? Always □ Often ○ Seldom ○ Never ○
10. Do you have problems with other people in the workplace? Always □ Often ○ Seldom ○ Never ○
11. Are your needs for support fulfilled by colleagues in the workplace? Yes □ No ○
12. Do you work at the expense of your private hours when required? Always □ Often ○ Seldom ○ Never ○
13. Are you anxious about your duties after working hours and/or during days off? Always □ Often ○ Seldom ○ Never ○
14. Do you want to be transferred or to change your occupation? Yes □ No ○
15. How is your health? In good health □ In poor health ○
16. How is your family's health? In good health □ In poor health ○
17. Are you satisfied with your income and/or living standards? Yes □ No ○
18. Do you have pleasures of a happy home? Always □ Often o Seldom ○ Never ○
19. Are there any problems within the family? Yes □ No ○
20. Do you have time to enjoy your favourite sport, hobbies or other recreational activities? Always □ Often o Seldom ○ Never ○
21. Do you feel your bedroom is too small? Yes □ No ○
22. Are you bothered by excessive outside noise at night? Always □ Often ○ Seldom ○ Never ○