A Cross-sectional Study of the Association between Working Hours and Sleep Duration among the Japanese Working Population

Tadahiro OHTSU1, Yoshitaka KANEITA2, Sayaka ARITAKE3, Kazuo MISHIMA4, Makoto UCHIYAMA5, Tsuneto AKASHIBA6, Naohisa UCHIMURA7, Shigeyuki NAKAJI8, Takeshi MUNEZAWA9, Akatsuki KOKAZE1 and Takashi OHIDA10

1Department of Public Health, Showa University School of Medicine, Japan, 2Department of Public Health and Epidemiology, Faculty of Medicine, Oita University, Japan, 3Department of Somnology, Tokyo Medical University, Japan, 4Department of Psychophysiology, National Institute of Mental Health, National Center of Neurology and Psychiatry, Japan, 5Department of Psychiatry, Nihon University School of Medicine, Japan, 6Department of Sleep and Respiratory Medicine, Nihon University School of Medicine, Japan, 7Department of Neuropsychiatry, Kurume University School of Medicine, Japan, 8Department of Social Medicine, Hirosaki University Graduate School of Medicine, Japan, 9ADVANTAGE Risk Management Co., Ltd., Japan and 10Department of Public Health, Nihon University School of Medicine, Japan

Abstract: A Cross-sectional Study of the Association between Working Hours and Sleep Duration among the Japanese Working Population: Tadahiro OHTSU, et al. Department of Public Health, Showa University School of Medicine, Japan—Objectives: This study aimed to clarify the association between long working hours and short sleep duration among Japanese workers. Methods: We selected 4,000 households from across Japan by stratified random sampling and conducted an interview survey of a total of 662 participants (372 men; 290 women) in November 2009. Logistic regression analyses were performed using “sleep duration <6 hours per day” as a dependent variable to examine the association between working hours/overtime hours and short sleep duration. Results: When male participants who worked for ≥7 but <9 hours per day were used as a reference, the odds ratio (OR) for short sleep duration in those who worked for ≥11 hours was 8.62 (95% confidence interval [CI]: 3.94−18.86). With regard to overtime hours among men, when participants without overtime were used as a reference, the OR for those whose period of overtime was ≥3 hours but <4 hours was 3.59 (95% CI: 1.42−9.08). For both men and women, those with long weekday working hours tended to have a short sleep duration during weekdays and holidays. Conclusions: It is essential to avoid working long hours in order to prevent short sleep duration. (J Occup Health 2013; 55: 307–311)

Key words: Holiday, Overtime hours, Sleep duration, Weekday, Working hours

Received Nov 6, 2012; Accepted Apr 5, 2013
Published online in J-STAGE May 2, 2013
 Correspondence to: Y. Kaneita, Department of Public Health and Epidemiology, Faculty of Medicine, Oita University, 1–1 Hasamamachi Idaigaoka, Yufu City, Oita 879-5593, Japan (e-mail: kaneita.yoshitaka@gmail.com)
Materials and Methods

The subjects of this study were selected as follows. A total of 4,000 households were randomly selected across the country, and 2,206 adults were home when the researchers visited the households; 1,224 of them (539 men and 685 women; response rate: 55.5%) agreed to participate in the interview survey. Of these, 662 (372 men; 290 women) agreed to participate in the interview survey. Approval was obtained from the Ethics Committee for Epidemiological Studies of Nihon University School of Medicine before the study began.

The survey included the following items: (1) sex, age, years of schooling completed (junior high/high school/college or university) and size of the city of residence (19 large cities/other cities/towns or villages); (2) working hours and overtime (extra working) hours per weekday; and (3) sleep duration per day on weekdays (workdays) and holidays (Sundays or days off). Regarding (2) and (3), participants were requested to select an answer about their status in the past month from among the categorical answer options provided. We did not ask about work patterns or burden of housework.

In our statistical analyses of working and overtime hours per weekday and sleep duration on weekdays and holidays, the composition in each category was calculated based on sex. The univariate logistic regression analyses used “sleep duration <6 hours per day” as a dependent variable and working hours or overtime hours as an explanatory variable and were performed for weekdays and holidays according to sex. Each model was adjusted for age class, years of schooling completed and size of the city of residence. The significance level was set at 5% (two-sided), and the IBM SPSS Statistics 20 software package was used for statistical analysis.

In Japan, overtime is defined as extra working hours that exceed 40 hours per week, excluding breaks, but including working hours on holidays (according to the Ministry of Health, Labour and Welfare integrated measures for prevention of health problems caused by overwork).

Results

Working hours, overtime hours and sleep duration are shown in Table 1 (classified according to sex). A large difference was observed between men and women with regard to working hours and overtime hours per weekday. The proportions of the participants with <6 hours’ sleep per day on weekdays and holidays were 34.8% and 16.8%, respectively, among men and 44.3% and 27.0%, respectively, among women. Thus, significant differences were observed between men and women for sleep duration on weekdays and holidays. The average ages (standard deviation) of the men and women were 45.0 (13.7) and 45.3 (12.6) years, respectively, and no significant age-related difference was observed (Mann-Whitney U test; \( p=0.491 \)).

The results of the logistic regression analyses using “sleep duration <6 hours per day” as a dependent variable are shown in Table 2. When participants working \( \geq 7 \) but \( <9 \) hours per day were used as a reference, the odds ratio (OR) for “sleep duration <6 hours per day” on weekdays was significantly higher among those working \( \geq 9 \) hours per weekday. In the same group of participants, the OR for holidays was also significantly high. With regard to overtime hours, when participants without overtime were used as a reference, the OR for having “sleep duration <6 hours per day” on

| Table 1. Gender-based working hours, overtime hours and sleep duration |
|------------------|------------------|------------------|------------------|
|                  | Men              | Women            | \( p \) value*   |
| Working hours per weekday | n=372*       | n=290*          | <0.001          |
| <5 h              | 5.1             | 27.2            |
| \( \geq 5 \) h, <7 h | 10.8            | 22.6            |
| \( \geq 7 \) h, <9 h | 51.4            | 36.2            |
| \( \geq 9 \) h, <11 h | 21.9            | 6.3             |
| \( \geq 11 \) h    | 10.8            | 7.7             |
| Overtime hours/ per weekday | <0.001        |                  |
| None              | 41.3            | 71.8            |
| <2 h              | 30.9            | 23.2            |
| \( \geq 2 \) h, <3 h | 9.9             | 2.5             |
| \( \geq 3 \) h, <4 h | 6.6             | 0.7             |
| \( \geq 4 \) h     | 11.3            | 1.8             |
| Sleep duration on weekdays\( a \) | 0.002         |                  |
| <6 h              | 34.8            | 44.3            |
| \( \geq 6 \) h, <7 h | 40.4            | 40.8            |
| \( \geq 7 \) h, <8 h | 19.1            | 13.5            |
| \( \geq 8 \) h     | 5.7             | 1.4             |
| Sleep duration on holidays\( a \) | <0.001        |                  |
| <6 h              | 16.8            | 27.0            |
| \( \geq 6 \) h, <7 h | 28.4            | 39.1            |
| \( \geq 7 \) h, <8 h | 33.2            | 22.8            |
| \( \geq 8 \) h, <9 h | 17.8            | 6.6             |
| \( \geq 9 \) h     | 3.8             | 4.5 (\%)        |

*In each section, the response “I do not know” was excluded from the statistical analyses. \( \chi^2 \) test. \( \chi^2 \) Extra working hours. \( \chi^2 \) Workdays. \( \chi^2 \) Sundays or days off.
weekdays was 3.59 (95% confidence interval [CI]: 1.42–9.08) among those working ≥3 but <4 hours overtime and 3.46 (95% CI: 1.64–7.30) among those working ≥4 hours overtime, indicating significantly high ORs. No significant OR was observed regarding holidays. Among women, the OR for “sleep duration <6 hours per day” on weekdays was significantly higher among those working ≥9 hours per day and that for holidays among the same group was 2.23 (95% CI: 0.97–5.12). There was no significant OR with regard to overtime hours.

**Discussion**

The results of this study show that the OR for “sleep duration <6 hours per day” was significantly higher among men working ≥9 hours per day or ≥3 hours overtime. The overall total of overtime was equivalent to >60 hours per month. In Japan, an amendment to the relevant law in 2005 made it obligatory for overworked workers to receive health guidance via an interview with a physician\(^1\). According to this legislation, 80 hours overtime per month (approximately 4 hours overtime per day) would prevent workers from sleeping the required total of approximately 6 hours per day\(^1\). The results of our study suggest a need to review this claim and are therefore noteworthy. Kageyama and colleagues reported a significant negative association between ≥60 hours overtime per month in the previous 3 months and sleep length on weekdays among Japanese white-collar workers\(^7\).

Almost half of the women in this study worked <7 hours per day, and most appeared to be part-time workers. For this group of women, the OR for having “<6 hours sleep” was high among those working ≥9 hours, as seen in men. In addition, although more than 70% of women did not work overtime, the proportions of those with <6 hours sleep on weekdays and holidays were higher than in men. The burden of doing housework in addition to employed work may explain this result. From our results, it is unclear to

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Sleep duration on weekdays(^b)</th>
<th>Sleep duration on holidays(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(^d)</td>
<td>AOR</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working hours per weekday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;7 h</td>
<td>58</td>
<td>1.67</td>
</tr>
<tr>
<td>≥7 h, &lt;9 h</td>
<td>190</td>
<td>1.00</td>
</tr>
<tr>
<td>≥9 h, &lt;11 h</td>
<td>81</td>
<td>2.76</td>
</tr>
<tr>
<td>≥11 h</td>
<td>40</td>
<td>8.62</td>
</tr>
<tr>
<td>Overtime hours(^e) per weekday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>150</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;2 h</td>
<td>111</td>
<td>0.91</td>
</tr>
<tr>
<td>≥2 h, &lt;3 h</td>
<td>36</td>
<td>1.05</td>
</tr>
<tr>
<td>≥3 h, &lt;4 h</td>
<td>24</td>
<td>3.59</td>
</tr>
<tr>
<td>≥4 h</td>
<td>41</td>
<td>3.46</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working hours per weekday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 h</td>
<td>78</td>
<td>1.13</td>
</tr>
<tr>
<td>≥5 h, &lt;7 h</td>
<td>65</td>
<td>1.58</td>
</tr>
<tr>
<td>≥7 h, &lt;9 h</td>
<td>104</td>
<td>1.00</td>
</tr>
<tr>
<td>≥9 h</td>
<td>40</td>
<td>2.51</td>
</tr>
<tr>
<td>Overtime hours(^e) per weekday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>203</td>
<td>1.00</td>
</tr>
<tr>
<td>&lt;2 h</td>
<td>66</td>
<td>1.58</td>
</tr>
<tr>
<td>≥2 h</td>
<td>14</td>
<td>0.68</td>
</tr>
</tbody>
</table>

\(^a\)Working hours and overtime hours were used as explanatory variables (univariate analysis). Each model was adjusted for age class, years of schooling completed and size of the city of residence. \(^b\)Workdays. \(^c\)Sundays or days off. \(^d\)In each section, the response “I do not know” was excluded from the statistical analyses. \(^e\)Extra working hours. AOR, adjusted odds ratio; CI, confidence interval.
what extent long working hours were associated with short sleep duration among women.

A cohort study conducted in the UK reported that the OR for short sleep duration (<7 hours) was 3.24 (95% CI: 1.45–7.27) among subjects working >55 hours per week when those with 35–40 working hours per week were used as a reference. In addition, large-scale cross-sectional studies conducted in Australia and the USA indicated that short sleep duration was associated with working long hours. The findings of these overseas studies appear to support our results, although the classifications of working hours and sleep duration differed.

In the present study, both men and women with long weekday working hours tended to have a short sleep duration (<6 hours) on weekdays as well as holidays. Two possible explanations for this are (1) that people working long hours on weekdays spend holidays attending to personal matters that cannot be taken care of on weekdays and (2) that they became accustomed to a short sleep duration. Kageyama and colleagues reported that the amount of overtime was positively correlated with the amount of time spent sleeping on the nights before holidays; however, a later report stated that sleep length before holidays was inversely correlated with overtime. This latter result concurs with that of our study.

This study had some limitations. First, the response rate was not particularly high (55.5%). It is possible that only respondents with enough spare time tended to participate in this survey. Thus, working hours may have been underestimated. In addition, as the ORs in Table 2 for both male and female participants working <7 hours per day were >1, selection bias caused by the low response rate would have led to underestimation of the present findings. Second, the types of jobs varied, and we did not investigate items that might have affected sleep duration, such as presence/absence of shift work, commuting time, and family composition. Third, questions on whether participants worked full-time or part-time and had housework burdens such as child-rearing and nursing care were not asked; these issues are particularly relevant to women. Belenky and colleagues stated in a recent report that occupational sleep medicine is a new field within sleep medicine. We hope to design a survey investigating sleep problems in terms of occupational health, in which the aforementioned limitations will be corrected.

This study examined the associations between working hours and sleep duration. Long working hours were associated with short sleep duration (<6 hours). In men, the OR for short sleep duration was significantly higher among participants with ≥3 hours of overtime per day. In addition, sleep duration was short on weekdays as well as on holidays among people with long working hours. It is essential to avoid working long hours in order to prevent short sleep duration.

Acknowledgments: This study was supported by a Health Science Research Grant from the Japanese Ministry of Health, Labour and Welfare (H20-Junkankitou-Ippan-002). The authors are very grateful to Dr. Hideyasu Aoyama, professor emeritus at Okayama University, for providing us with strong motivation while developing this report.

References

12) Iwasaki K, Takahashi M, Nakata A. Health problems due to long working hours in Japan: working hours, worker’s compensation (Karoshi), and preventive measures. Ind Health 2006; 44: 537–40.

