Effects of lifestyle factors on job-related stress and stress responses in police officers in Japan

（日本人警察官における職業性ストレスと
ストレス反応に及ぼす生活習慣の影響）

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Abstract

Objective

The aim of this study was to investigate the relationship between stress responses and lifestyle factors of police officers in Japan.

Methods

This study used a cross-sectional design. Of individuals who underwent legally required health screenings in a Prefectural Police, 9633 men and 1086 women completed the Brief Job Stress Questionnaire. Then a multivariate analysis for various lifestyle factors was performed with high stress and six stress responses (low vitality, high irritability, high fatigue, high anxiety, substantial depressive feeling, and high somatic symptoms) as dependent variables.

Results

Of the potential covariates, short sleep duration consistently related to various stress and stress responses. The odds ratios of short sleep duration were consistently significant for high stress in men and women, for high irritability in men, for high fatigue in women, for high depressive feeling in men and women, and for high somatic symptoms in men and women. As for factors other than sleep duration, age, rank, marital status, overtime work, and rhythm of daily life were significantly associated with high stress and various stress responses.

Conclusions

The results of this study consistently showed that short sleep duration increases the risk of high stress and stress responses. Overall, more women than men in the police force reported short sleep duration, which may be due to work–family conflicts. Maintaining adequate sleep duration quality would reinforce preventive measures to avoid aggravation of stress status.

Keywords: police officers; job-related stress; stress reaction; sleep duration; work-life balance

Introduction

In recent disaster situations such as the Great East Japan Earthquake and Tsunami, public safety officers such as police and firefighters, who are responsible for public safety, are an essential part of the social infrastructure to ensure the security and safety of the population. In Japan, the police profession is the largest safety and security organization in most local communities, but police work is one of the most stressful professions due to the unpredictable working hours and work systems, activities such as investigations and apprehension of criminals, and multiple other factors.

Overall, the trends for deaths among members of the police force due to job-related illnesses have significantly increased in frequency and rate in the USA (Violanti et al. 2020). These increases are due in part to a higher incidence of cancer and circulatory deaths. In addition in Italy, the majority of police officers report having high stress levels (Garbarino and Magnavita 2015). At follow-up, police officers who had stress levels in the highest quartile had significantly higher mean levels of triglycerides, lower levels of HDL cholesterol and increased risk of developing metabolic syndrome (Garbarino and Magnavita 2015). Police officers constitute a high-risk group for mental health morbidities such as post-traumatic stress disorder, anxiety disorders, depression, suicidal thoughts and behaviors (Galanis et al. 2021; Stanley et al. 2016; Stuart 2008), and the rate of suicides among police officers is higher than that of the

general population. Thus, development of effective mental health measures for police officers is urgently needed.

In 2015, the Ministry of Health, Labor, and Welfare in Japan launched a new occupational health policy called the Stress Check Program to screen employees for high psychosocial stress in the workplace (Kawakami and Tsutsumi 2016; Tsutsumi et al. 2018). However, since the launch of the Stress Check Program, there have been no apparent reductions in the number of long-term absences of police officers from work due to mental illness. There are certain limits to how the work itself and the working environment of police officers can be improved, either at an organizational or individual level. Therefore, even if stress factors related to mental illness can be clarified, taking essential actions to improve working environments can be difficult. Psychological care for individuals may be required but the organizational preventive support provided by Stress Check Programs is often limited to promoting personal awareness of the accumulation of stress. Actual support for high stress individuals as a secondary prevention measure can start with medical interviews conducted by an occupational physician.

In terms of lifestyle factors, previous studies indicated the link between health and sleep quality and quantity (Kubo et al. 2021; Omichi et al. 2022; Tahara et al. 2021); therefore, it would be effective for police officers to have systematic improvements in preventive support

such as lifestyle guidance. However, to our knowledge, no studies have investigated the relationship between stress and lifestyle factors of police officers in Japan, or what measures would be effective for police officers to cope with stress. The aim of this study was to investigate stress factors and reactions of police officers using a stress check, as well as to investigate the relationship between stress and lifestyle factors. Results of this study could help improve individual stress control and work engagement in police officers in Japan by identifying preventive measures that can be implemented at an organizational level before physical and mental reactions to stress are perceived.

Methods

Participants

The design of this study was cross-sectional. In 2021, 9660 men and 1090 women who were members of the Prefectural Police in Japan underwent legally required annual health screenings. I distributed questionnaires and asked the study participants to fill out the questionnaires at the time of their health check-up. I collected the completed questionnaires at the end of the health check. The health check-up rate and the questionnaire return rate was 100%. Among the workers, 27 men and 4 women were excluded due to missing information concerning lifestyle factors or job-related stress. Finally, 9633 men and 1086 women were included in this study.

Questionnaires for lifestyle factors

The self-administered questionnaire was used to collect information about daily sleep duration (< 4 h, 4–5 h, 5–6 h, 6–7 h, > 7 h), alcohol consumption (never, sometimes, everyday), smoking (nonsmoker, smoker), weekly exercise (≥ 5 times, 2–4 times, once or fewer), meals missed (rarely, 2–3 times a week, once or more a day), rhythm of daily life (regular, occasionally irregular, irregular), days off (almost twice a week, once a week, almost none), and overtime work (very little, sometimes, always). Alcohol consumption also refers to the number of drinking days per week. “Sometimes” corresponds to person other than non-drinkers and daily drinkers. Weekly exercise is also assumed to the number of days exercised at least 30 min. The rhythm of daily life asked about the consistency of circadian rhythms such as eating and sleeping. Other information for age group (18–29 years, 30–39 years, 40–49 years, ≥ 50 years), rank (superintendent or higher, chief inspector, inspector, sergeant, police officer), type of job schedule (shift, day), and marital status (married, not married) was matched with personnel records.

Questionnaires for stress and stress responses

A Stress Check Program at each workplace in Japan has been legally required since 2015 (Kawakami and Tsutsumi 2016; Tsutsumi et al. 2018), and the Brief Job Stress Questionnaire (BJSQ) is recommended by the Ministry of Health, Labour and Welfare (2015) as a method to assess the stress situation of workers (high stress). The utility and validity of the BJSQ for the

Stress Check Program has been verified in various previous studies in Japan (Tsutsumi et al. 2020).

High stress is defined as the highest level of stress response or having a moderate or higher level of stress response, together with having the highest number of job stressors or lowest support in the workplace (Kawakami and Tsutsumi 2016; Tsutsumi et al. 2018). The Stress Check Program also requires that an employer arrange an interview with a physician for high stress employees, and follow the physician's recommendations to address the effects of adverse working conditions (Tsutsumi et al. 2018). The present study is based on the results of the BJSQ in this Stress Check Program. I adopted high stress, low vitality, high irritability, high fatigue, high anxiety, substantial depressive feeling, and high somatic symptoms (Kawano 2008) as dependent outcome responses using a score conversion method (Ministry of Health, Labour and Welfare 2017). This conversion method replaces each response scale with a five-point rating (1 point = high, 5 points = low) based on a score conversion table (Online Resource 1), and the scores were then summed for general stress status. High stress was present if the sum of the response scores was ≤ 12 points (6 to 30 points), or if the sum of the response scores was ≤ 17 points and the sum of the scores for the job stressors and support in the workplace was ≤ 26 points (13 to 59 points). The study protocol was approved by the ethical review boards of the Graduate School of Medicine, Chiba University.

Statistical analysis

Multivariate analysis for various lifestyle factors was performed using logistic regression analysis, with high stress and the six stress responses as dependent variables. Lifestyle factors and other potential covariates were included in the statistical model. Then model selection was performed using a backward elimination method based on the likelihood ratio. Excluded covariates indicated that they were not significant in the final model.

Odds ratios for daily sleep duration (< 5 h), alcohol consumption (everyday), smoking (smoker), weekly exercise (once or less), meals missed (once or more a day), rhythm of daily life (irregular), days off (almost none), overtime work (always), job schedule type (shift), and marital status (married) were estimated compared to the other groups for each item. Dummy variables were constructed for the age group and rank of police using groups of 18–29 years-old and police officer as the control category. Due to the small number of officers who had a higher rank, these categories were combined with grouping of chief inspector or higher for men and inspector or higher for women.

All analyses were performed using IBM SPSS 19 J statistical software (IBM Business Analytics, Tokyo, Japan). P values < 0.05 were considered statistically significant.

Results

The basic characteristics of participants were collected from the completed questionnaires and were grouped according to sex (Table 1). Meanwhile, short sleep duration

was reported more frequently by women, so the distribution of short sleep duration for shift work, marital status, and the combination of shift work and marital status (married) was compared by gender (Figs. 1, 2 and 3). Nearly one-third (31.9%) of female married police officers who undertook shift work reported having short (< 5 h/night) sleep duration.

Then the prevalence of high stress or stress responses in men and women were shown in Table 2.

The odds ratios and 95% confidence intervals for each outcome were determined using multiple logistic regression with model selection (Tables 3, 4, 5, 6, 7, 8, and 9). The obtained variance inflation factors for all variables were less than 2, indicating that there is no concern for any multicollinearity. Of the potential covariates, short sleep duration consistently related to various stress and stress responses. Both men and women showed significant odds ratios for short sleep duration that were significant for high stress, high depressive feeling, and high somatic symptoms. The odds ratios for short sleep duration were significant for high irritability in men and for high fatigue in women.

In terms of age, low vitality and high somatic symptoms were significantly higher for older age groups in both men and women. In older men (40–49 years, 50 years or older), the risk of high stress was significantly higher, but the risk of high depressive feeling was significantly lower (30–39 years). The risk of high somatic symptoms was also significantly higher in older women. For rank, men having higher rank had significantly lower risk of high

stress, high irritability, high anxiety, high depressive feeling, and high somatic symptoms. Women with higher rank had lower risk of high somatic symptoms. For marital status, married men had reduced risk of high stress, low vitality, high irritability, high fatigue, high anxiety, and high depressive feeling. Men and women who reported having an irregular rhythm of daily life had a significantly increased risk of high somatic symptoms, whereas men were at increased risk of high stress, low vitality, high irritability, high fatigue, high anxiety, and high depressive feeling. Women officers engaged in shift work had a significantly increased risk of high irritability, high fatigue, high anxiety, and high depressive feeling.

For men, the odds ratios of overtime work was significantly increased for high stress and high fatigue, fewer days off was associated with high fatigue and high anxiety, and less exercise and missing meals was related to low vitality. In contrast, the odds ratios of low vitality and high fatigue was significantly lower for men who smoked. Men who exercised fewer hours were less likely to have high irritability and high anxiety, and those who consumed alcohol were less likely to have high fatigue. In women, fewer days off was associated with high stress, high irritability, and high somatic symptoms. The odds ratios for high stress, low vitality, high anxiety, and high somatic symptoms was significantly higher for those who missed meals, smoked, smoked, and exercised less, respectively.

Discussion

In this study, I used data collected from questionnaires completed by women and men who were members of the police force in Japan to examine the relationship between stress and lifestyle factors, particularly changes in sleep patterns. These questionnaires were given at annual health check-ups and the completion rate was 100%. In this study cohort, women were more likely to have short sleep duration (< 5 h/day) than men. This decrease in sleep was associated with significantly higher risk for various outcomes for stress and stress responses (Tables 3, 4, 5, 6, 7, 8, and 9). Men and women who reported having less sleep had higher risk for high stress, depressive feeling, and somatic symptoms whereas the risk for irritability in men and fatigue in women was significantly higher. Together, these results indicate that short sleep duration is associated with physical and mental stress reactions in both men and women. For women in particular, short sleep duration had the highest number of associated high-risk items among the 12 factors studied. Among these, the lower limit of the odds ratio was 1.78 for fatigue, indicating a strong association with short sleep duration (Table 6).

In women, short sleep duration may be due to other reasons than job workload such as burdens at home like housework and childcare. Approximately 70% of men and 40% of women in the study group were married and the effects of marital status on stress reactions differed significantly between men and women. Married men had a lower risk of six of the seven stress responses (high stress, vitality, irritability, fatigue, anxiety, and depressive feeling) examined,

whereas women had no significant difference in high stress or stress responses based on marital status. Therefore, I examined sleep status based on marital status. The likelihood of short sleep duration also differed among men and women depending on marital status in that unmarried men and married women were more likely to have short sleep duration (Fig. 1).

Shift work may increase the risk of stress reactions in women who are police officers. The police organization under study has a 24-h shift system, and approximately 40% of men and 20% of women engage in shift work. Women who had shift work were at higher risk for irritability, fatigue, and depressive feeling, but no significant risk was seen for men. Except for short sleep duration, shift work showed the significant risk for various stress reactions examined here. Although not statistically significant, women engaged in shift work were 3.2% more likely to have shorter sleep duration than women working daily shifts (Fig. 2).

We next compared risks associated with short sleep duration together with shift work and marital status in terms of gender. Women who were married and engaged in shift work were twice as likely to have short sleep duration than those who were married but worked days (31.9% vs. 15.4%). On the other hand, in men the frequency of short sleep duration was similar between day and shift work (10.1% vs. 10.4%). Together, the fraction of married women who worked shifts and had short sleep duration was three times higher than that for married men

who were in shift work (Fig. 3). One explanation for the substantial difference in the association between marital status and stress reactions between men and women is that women spend more time on off-duty days and public holidays attending to domestic roles and have less time to devote to sleep than married men.

At least 30% of married female police officers appeared to have difficulty getting enough sleep, even after a 24-h shift. Short sleep duration increases the risk of fatigue among women, which may have an impact on safety and productivity while on duty. A summary by the Organization for Economic Cooperation and Development (OECD) reported that, on average, Japanese had the fewest number of sleeping hours among 33 countries surveyed, at 7 h and 22 min. Moreover, Japanese women slept 7 h 15 min, 13 min less than men, and Japanese women had the shortest sleep duration in the world (OECD 2021).

“Work–life balance” focuses on preventing overwork, harmonizing work and life, and balancing work and family. In Japan, however, women are responsible for most of the “housework/childcare/caregiving” and thus overwork may be due not only to employment but also the effects of overwork from other activities like housework. As such, in parallel with the changes in family structure in Japan, such as an increase in the number of dual-income

households, it is increasingly apparent that men must play a more proactive role in "housework/childcare/caregiving" (Cabinet Office, Government of Japan 2020).

One concept that focuses on the positive aspects of taking on multiple roles in work and family is positive spillover (Bakker and Demerouti 2013). In our study population, 70% of male police officers were married, and married men were at lower risk for most of the stress response items examined. Being married may increase family activeness (e.g., discretion and support at home) that increase "family-to-work positive spillover" (Shimada et al. 2010). Meanwhile, for women, the qualitative and quantitative burden of work might increase such that "work-to-family negative spillover" occurs (Shimada et al. 2010). Therefore, positive spillover as a possible factor to reduce the risk of stress among married male police officers should be considered, while initiatives that can mitigate negative spillover among married female police officers are needed. Such initiatives could in turn improve the overall sleep duration of police officers as a whole. Among men and women police officers who are not married, the burden of household chores is expected to increase, particularly if they are raising children or are in charge of caring for family members. Thus, the roles of single officers in the household may vary in multiple ways. I believe that favorable results obtained from efforts to reduce the frequency of "short sleep duration" and increase good stress status in married men could be expanded more broadly to police officers who have various family compositions.

Rhythm of daily life was another strong factor that influenced multiple stress responses. In this study population, around 20% of both men and women reported having an irregular rhythm of daily life. For men, irregular rhythm of daily life was associated with higher risk for all seven stress categories: high stress, vitality, irritability, fatigue, anxiety, depressive feeling, and somatic symptoms. Among women with irregular rhythm of daily life, the risk was higher for only somatic symptoms. I observed no apparent increased risk for shift work among men, suggesting that maintaining a regular rhythm of daily life may be more beneficial for stress reactions than a decrease in shift work among police officers. Police officers often cannot easily control their working schedules and thus tend to have irregular rhythm of daily life since they are required to respond to accidents, investigate crimes, and perform security duties at various times, regardless of whether they are engaged in shift-work or day-work. Irregular rhythm of daily life can also impact sleep patterns. Both short sleep duration and irregular sleep are shown to be associated with disease onset, progression, and mortality (Kubo et al. 2021; Omichi et al. 2022). Furthermore, irregular work schedules can compromise engagement in the full range of activities of an individual's personal life and eventually affect self-care such as exercise and rest, as well as interactions with family and friends. Such effects on family lives could also affect interactions with family members, reducing the positive spillover that being married provides. As such, the negative spillover from work to family is likely to be greater.

Shimada et al. reported that contemporary society has more dual-earner families and longer working hours, and thus maintaining a balance between work and family roles is becoming an important issue for both males and females (Shimada et al. 2010). Therefore, from the perspective of management, supporting individuals who are coping with factors outside the workplace that are affecting their family lives is important and may help ensure appropriate sleep duration and rhythm of daily life. Police officers in particular often have difficulty avoiding work on days off due to the conventional organizational atmosphere of the police force that discourages days off. However, police organizations should attempt to manage the work of police officers while taking into account responsibilities they may have at home which will promote work–life balance throughout the workplace and increase work engagement of individual officers. Such increased work engagement should enhance positive emotions of officers that will in turn have a positive impact on family life and reinforce positive spillover from work to home (Bakker and Demerouti 2013; Bakker et al. 2014; Shimazu et al. 2009).

Although police officers may be required to work overtime and on days off, the atmosphere in the workplace has been changing in recent years such that employees who have a variety of circumstances, such as housework, childcare, and nursing care responsibilities, can continue working. However, simply shortening the working hours of employees who cannot

work overtime is insufficient to ensure that workers have adequate support. Creation of a favorable work environment that is accepting of obligations outside of work can enhance work engagement of workers who are unable to work overtime or on days off, providing the opportunity to advance their careers as police officers. For those employees who are more likely to be required to work overtime or work on days off, such as single or younger employees, work–life balance can be promoted by understanding and giving consideration to their sleep duration, life rhythm, and awareness of fatigue in the workplace, thereby promoting self-care and enrichment of these individuals' lives outside of work. The provision of lifestyle considerations will enable diverse staff members to work together to create a crossover effect (Bakker et al. 2014; Shimazu et al. 2009) that can further increase work engagement of workers. Fewer days off was also associated with several outcomes in men and women, suggesting the importance of days off in police officers.

Due to the very specific nature of their job demands, police officers are expected to have a higher level of mental and physical health than the general public. Therefore, officers may tend to refrain from disclosing negative information about their own mental and health conditions to avoid potential damage to their careers (Marshall et al. 2021). Officers may instead be less resistant to answer questions concerning their daily life, such as sleeping hours and rhythm of daily life, compared to answering questions about their mental conditions.

Information about factors associated with daily life can be an important indicator to accurately assess physical condition and fatigue. Considering the very specific nature of the police profession, health management teams in police departments could promote health management based on daily life information that officers may more freely provide while strictly protecting the health information of each individual.

In terms of rank, the risk of high stress, anxiety, and somatic symptoms was lower for men who had higher rank. In addition, the risk of irritability was lower for men who had achieved chief inspector or higher. Among women, the risk of somatic symptoms was lower for those who had the rank of chief inspector or higher. This lower risk of stress responses among both men and women officers of higher rank may be due to the lower likelihood of their working in the field, of engaging in shift work, and working overtime, such that they may more easily maintain a regular rhythm of daily life. In addition, the higher ranks were more likely to have better job control, which also reduced the risk of stress responses. Actually in this study, low job control measured by BJSQ was significantly less frequent at higher rank in men. For women, clear results could not be detected since fewer women than men had achieved higher ranks.

For men, smoking decreased the risks for low vitality and high fatigue, whereas for women smoking increased the risk of low vitality. Mental illness has been associated with both

higher rates and amounts of smoking in the United States and Australia (Lawrence et al. 2009). Therefore, the results seen here may not be an effect of smoking per se. Since smoking is not usually allowed inside office buildings in Japan, smokers must go outside to a designated area where smoking is allowed. Such smoking areas could provide social opportunities as smokers could engage in conversation with others. However, in our study population, few women (6%) were smokers, suggesting that they would have few same-sex colleagues to chat with while smoking. Moreover, the risks associated with smoking are especially serious for women (Tsuji 2020), and here women may smoke, despite these risks, as a way to reduce stress reactions. As a preventive mental health measure, nonsmokers should also be provided with short breaks during which they can leave the workplace and chat with other employees.

Limitations

One limitation of this study was that the prevalence of high stress and stress responses was generally low. As noted above, officers may tend to avoid releasing their actual mental status, yielding possibilities of low detection power and type II error. However, I believe that the significant results in this study are sufficiently reliable because of the large sample size. Another limitation was that the present study population had substantially fewer women than men, so future research should focus on stressors that are specific to women, such as conflicts between home and work, as well as holiday and overtime work of police officers. Furthermore,

I could not implement a validated questionnaire that could completely quantify lifestyle factors. Since this survey was conducted at the time of the legally required annual health screenings, the questionnaire was intended to obtain a broad picture of lifestyle factors while avoiding excessively burdening participants. As for anonymity, the participants may not have dared to give honest answers to the questions on mental health that required a notation. However, the stress check program requires feedback from occupational health staff to the workers with high stress. Therefore, the results of this survey, which is not anonymous, would be more useful for generalization to other workplaces where names are required.

Due to the cross-sectional design, a strict causal relationship may not be proven in the present study. As a healthy worker effect, people with higher stress and susceptible to such stress may have already left the workforce. In addition, the questions for the lifestyle factors was broad, which would lead to a vague measurement of exposure. Future studies should investigate lifestyle habits in detail and longitudinally to clarify the causal relationship of the associations shown in the present study.

Conclusions

This study consistently showed that short sleep duration increases the risk of high stress and stress reactions in police officers. Maintaining adequate sleep duration and sleep quality would provide reinforcement of preventive measures before aggravation of stress status. An examination of the distribution of individuals with short sleep duration in combination with

gender and marital status reflected differences in domestic roles between men and women, as well as positive and negative spillover from work to home and home to work. In addition, irregular rhythm of daily life and fewer days off were associated with many of the outcomes, and improving these factors may be effective for stress management in the police officers. Furthermore, lower rank, older age, shift work, and marital status (not married) were at higher risk for various outcomes. Though medical interventions for these factors are difficult to implement, providing sufficient information about these risks may be an effective countermeasure for job-related stress.

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Table 1. Study participant characteristics.

		Men (N=9,633)		Women (N=1,086)	
		N	%	N	%
Age (years)	18-29	2,310	24.0%	471	43.4%
	30-39	2,735	28.4%	338	31.1%
	40-49	2,689	27.9%	198	18.2%
	50-	1,899	19.7%	79	7.3%
Sleep duration	<5 hr/day	1,027	10.7%	173	15.9%
	≥5 hr/day	8606	89.3%	913	84.1%
Rank of police	Superintendent or higher	274	2.8%	3	0.3%
	Chief inspector	676	7.0%	21	1.9%
	Inspector	2,793	29.0%	113	10.4%
	Sergeant	2,864	29.7%	339	31.2%
	Police officer	3,026	31.4%	610	56.2%
Job Schedule Type	Shift	3,875	40.2%	256	23.6%
	Day	5,758	59.8%	830	76.4%
Marital status	Married	6,688	69.4%	476	43.8%
	Not married	2,945	30.6%	610	56.2%
Alcohol consumption	Everyday	1,313	13.6%	59	5.4%
	Not everyday	8,320	86.4%	1,027	94.6%
Smoking	Smoker	3,526	36.6%	65	6.0%
	Nonsmoker	6,107	63.4%	1,021	94.0%
Exercise	Once or less /week	5,437	56.4%	756	69.6%
	Twice or more /week	4,196	43.6%	330	30.4%
Meals missed	One or more /day	1,293	13.4%	119	11.0%
	2-3 times/week or fewer	8,340	86.6%	967	89.0%
Days off	Almost no days off	88	0.9%	7	0.6%
	1-2 days/week	9,545	99.1%	1,079	99.4%
Overtime work	Always	75	0.8%	10	0.9%
	Sometimes or very little	9,558	99.2%	1,076	99.1%
Rhythm of daily life	Irregular	2,146	22.3%	221	20.3%
	Occasionally irregular or regular	7,487	77.7%	865	79.7%

Table 2. Prevalence of stress or stress responses in men and women.

	Men			Women		
	N (%)			N (%)		
High stress	336 (3.5%)			50 (4.6%)		
Stress	High	Low	Total	High	Low	Total
Low vitality	122 (36.3%)	234 (2.5%)	356 (3.7%)	21 (42.0%)	47 (4.5%)	68 (6.3%)
High irritability	119 (35.4%)	82 (0.9%)	201 (2.1%)	15 (30.0%)	11 (1.1%)	26 (2.4%)
High fatigue	112 (33.3%)	74 (0.8%)	186 (1.9%)	19 (38.0%)	7 (0.7%)	26 (2.4%)
High anxiety	151 (44.9%)	131 (1.4%)	282 (2.9%)	10 (20.0%)	19 (1.8%)	29 (2.7%)
High depressive feeling	165 (49.1%)	35 (0.4%)	200 (2.1%)	23 (46.0%)	7 (0.7%)	30 (2.8%)
High somatic symptoms	206 (61.3%)	194 (2.1%)	400 (4.2%)	21 (42.0%)	22 (2.1%)	43 (4.0%)

Table 3. Odds ratios and 95% confidence intervals for high stress.

		OR[a] (95% CI[b])	*P*
Men	Age group (18-29)		
	30-39	1.26 (0.88-1.80)	0.211
	40-49	2.40 (1.62-3.57)	<0.001
	50 or older	2.22 (1.43-3.45)	<0.001
	Sleep duration (<5 hr/day)	1.48 (1.10-2.00)	0.009
	Rank (/police officer)		
	Chief inspector or higher	0.28 (0.15-0.53)	<0.001
	Inspector	0.61 (0.42-0.89)	0.010
	Sergeant	0.60 (0.42-0.84)	0.003
	Marital status (Married)	0.55 (0.42-0.71)	<0.001
	Overtime work (Always)	3.10 (1.45-6.60)	0.003
	Rhythm of daily life (Irregular)	2.02 (1.60-2.55)	<0.001
Women	Sleep duration (<5 hr/day)	2.03 (1.06-3.88)	0.032
	Meals missed (Once or more/day)	2.55 (1.28-5.08)	0.008
	Days off (Almost no days off)	6.98 (1.28-38.01)	0.025

[a]Odds ratio. [b]Confidence intervals.

Table 4. Odds ratios and 95% confidence intervals for low vitality.

		OR[a] (95% CI[b])	*P*
Men	Age group (18-29)		
	30-39	1.68 (1.13-2.50)	0.011
	40-49	3.43 (2.35-4.99)	<0.001
	50 or older	5.08 (3.46-7.47)	<0.001
	Marital status (Married)	0.55 (0.43-0.72)	<0.001
	Smoking (Smoker)	0.71 (0.56-0.89)	0.004
	Exercise (Once or less/week)	1.48 (1.18-1.87)	0.001
	Meals missed (Once or more/day)	1.39 (1.04-1.86)	0.025
	Rhythm of daily life (Irregular)	1.86 (1.47-2.35)	<0.001
Women	Age group (18-29)		
	30-39	1.57 (0.83-2.97)	0.164
	40-49	2.04 (1.03-4.05)	0.042
	50 or more	2.98 (1.29-6.89)	0.011
	Smoking (Smoker)	2.62 (1.23-5.60)	0.013
	Exercise (Once or less/week)	1.74 (0.92-3.28)	0.086

[a]Odds ratio. [b]Confidence intervals.

Table 5. Odds ratios and 95% confidence intervals for high irritability.

		OR[a] (95% CI[b])	*P*
Men	Sleep duration (<5 hr/day)	1.68 (1.16-2.44)	0.006
	Rank (/police officer)		
	Chief inspector or higher	0.29 (0.12-0.75)	0.010
	Inspector	0.87 (0.57-1.31)	0.495
	Sergeant	1.11 (0.77-1.58)	0.585
	Marital status (Married)	0.67 (0.48-0.94)	0.018
	Exercise (Once or less/week)	0.74 (0.56-0.98)	0.039
	Rhythm of daily life (Irregular)	1.78 (1.32-2.40)	<0.001
Women	Sleep duration (<5 hr/day)	2.27 (0.96-5.38)	0.063
	Job Schedule Type (Shift)	3.35 (1.52-7.42)	0.003
	Days off (Almost no days off)	17.25 (3.04-97.86)	0.001

[a]Odds ratio. [b]Confidence intervals.

Table 6. Odds ratios and 95% confidence intervals for high fatigue.

		OR[a] (95% CI[b])	*P*
Men	Age group (18-29)		
	30-39	0.63 (0.38-1.04)	0.073
	40-49	1.28 (0.75-2.19)	0.359
	50 or more	1.65 (0.93-2.94)	0.088
	Rank (/police officer)		
	Chief inspector or higher	0.46 (0.20-1.07)	0.071
	Inspector	0.67 (0.38-1.18)	0.167
	Sergeant	1.10 (0.69-1.74)	0.692
	Job Schedule Type (Shift)	0.74 (0.54-1.03)	0.072
	Marital status (Married)	0.50 (0.35-0.72)	<0.001
	Alcohol consumption (Everyday)	0.54 (0.29-1.01)	0.056
	Smoking (Smoker)	0.61 (0.44-0.85)	0.004
	Days off (Almost no days off)	3.81 (1.74-8.32)	0.001
	Overtime work (Always)	3.17 (1.32-7.63)	0.010
	Rhythm of daily life (Irregular)	2.49 (1.81-3.44)	<0.001
Women	Age group (/18-29)		
	30-39	2.26 (0.74-6.88)	0.150
	40-49	4.31 (1.44-12.93)	0.009
	50 or more	2.59 (0.62-10.81)	0.191
	Sleep duration (<5 hr/day)	4.04 (1.78-9.19)	0.001
	Job Schedule Type (Shift)	3.50 (1.47-8.34)	0.005

[a]Odds ratio. [b]Confidence intervals.

Table 7. Odds ratios and 95% confidence intervals for high anxiety.

		OR[a] (95% CI[b])	*P*
Men	Rank (/police officer)		
	Chief inspector or higher	0.36 (0.19-0.68)	0.002
	Inspector	0.57 (0.40-0.81)	0.002
	Sergeant	0.56 (0.41-0.78)	0.001
	Marital status (Married)	0.66 (0.49-0.87)	0.004
	Exercise (Once or less /week)	0.73 (0.57-0.93)	0.012
	Days off (Almost no days off)	4.10 (2.06-8.16)	<0.001
	Rhythm of daily life (Irregular)	1.73 (1.34-2.24)	<0.001
Women	Job Schedule Type (Shift)	2.58 (1.22-5.46)	0.013
	Smoking (Smoker)	3.11 (1.13-8.53)	0.027

[a]Odds ratio. [b]Confidence intervals.

Table 8. Odds ratios and 95% confidence intervals for high depressive feeling.

		OR[a] (95% CI[b])	*P*
Men	Age group (/18-29)		
	30-39	0.61 (0.38-0.96)	0.032
	40-49	1.01 (0.60-1.69)	0.967
	50 or more	0.67 (0.36-1.25)	0.207
	Sleep duration (<5 hr/day)	1.73 (1.19-2.53)	0.005
	Rank (/police officer)		
	Chief inspector or higher	0.30 (0.12-0.77)	0.012
	Inspector	0.63 (0.37-1.08)	0.093
	Sergeant	0.73 (0.47-1.14)	0.167
	Marital status (Married)	0.56 (0.40-0.80)	0.001
	Exercise (Once or less /week)	0.74 (0.56-0.99)	0.043
	Rhythm of daily life (Irregular)	1.41 (1.03-1.91)	0.030
Women	Sleep duration (< 5 hr/day)	2.82 (1.28-6.21)	0.010
	Rank (/police officer)		
	Inspector or higher	0.18 (0.02-1.39)	0.100
	Sergeant	0.48 (0.19-1.22)	0.123
	Job Schedule Type (Shift)	2.25 (1.05-4.83)	0.038
	Alcohol consumption (Everyday)	3.59 (0.99-13.06)	0.052

[a]Odds ratio. [b]Confidence intervals.

Table 9. Odds ratios and 95% confidence intervals for high somatic symptoms

		OR[a] (95% CI[b])	*P*
Men	Age group (/18-29)		
	30-39	0.76 (0.55-1.07)	0.114
	40-49	1.55 (1.09-2.21)	0.015
	50 or more	1.95 (1.33-2.86)	0.001
	Sleep duration (<5 hr/day)	1.87 (1.44-2.43)	<0.001
	Rank (/police officer)		
	Chief inspector or higher	0.28 (0.17-0.49)	<0.001
	Inspector	0.51 (0.36-0.73)	<0.001
	Sergeant	0.68 (0.50-0.93)	0.016
	Meals missed (Once or more /day)	1.27 (0.97-1.66)	0.081
	Rhythm of life (Irregular)	1.72 (1.38-2.14)	<0.001
Women	Age group (/18-29)		
	30-39	0.39 (0.12-1.20)	0.099
	40-49	3.15 (1.30-7.67)	0.011
	50 or more	1.05 (0.19-5.92)	0.958
	Sleep duration (<5 hr/day)	3.39 (1.73-6.67)	<0.001
	Rank (/police officer)		
	Inspector or higher	0.08 (0.01-0.69)	0.021
	Sergeant	0.52 (0.22-1.21)	0.130
	Exercise (Once or less /week)	2.63 (1.11-6.22)	0.027
	Days off (Almost no days off)	9.79 (1.29-74.30)	0.027
	Rhythm of daily life (Irregular)	2.88 (1.39-5.98)	0.005

[a]Odds ratio. [b]Confidence intervals.

Figure 1. Distribution of short sleep duration (<5 hr/day) grouped according to gender and marital status.

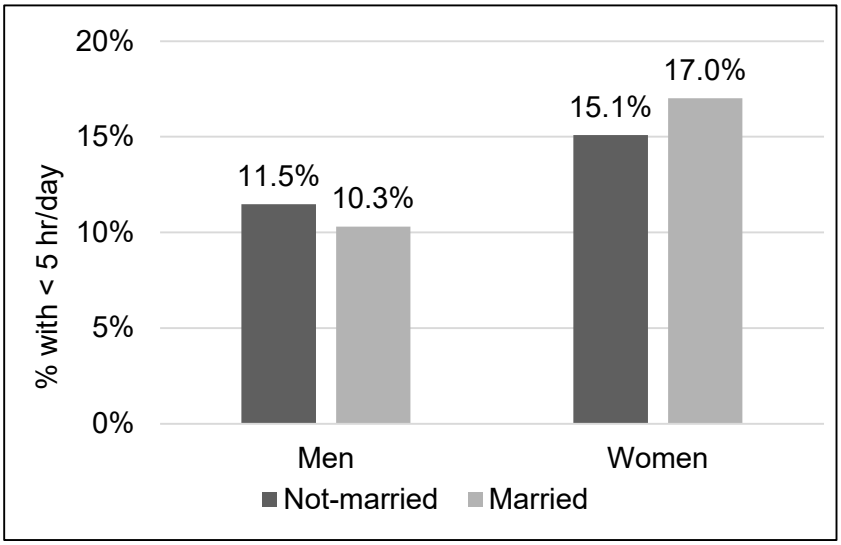


Figure 2. Distribution of short sleep duration (<5 hr/day) grouped according to gender and shiftwork.

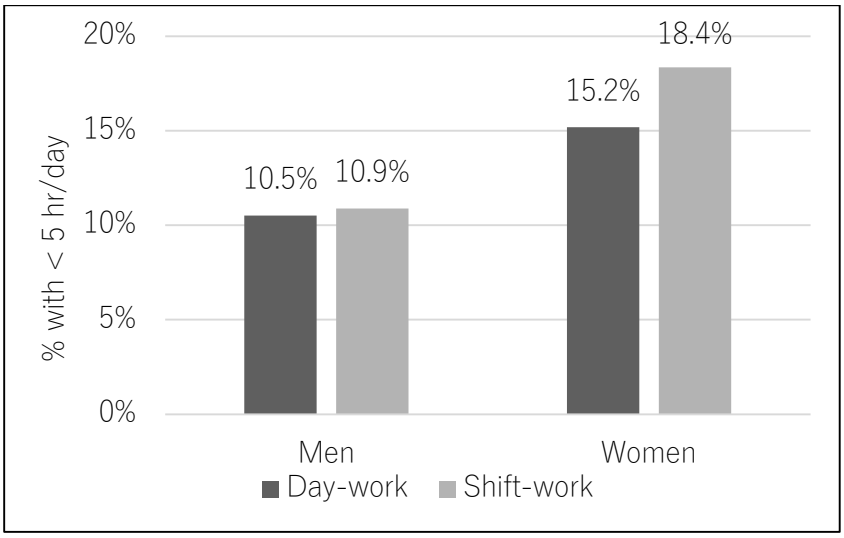
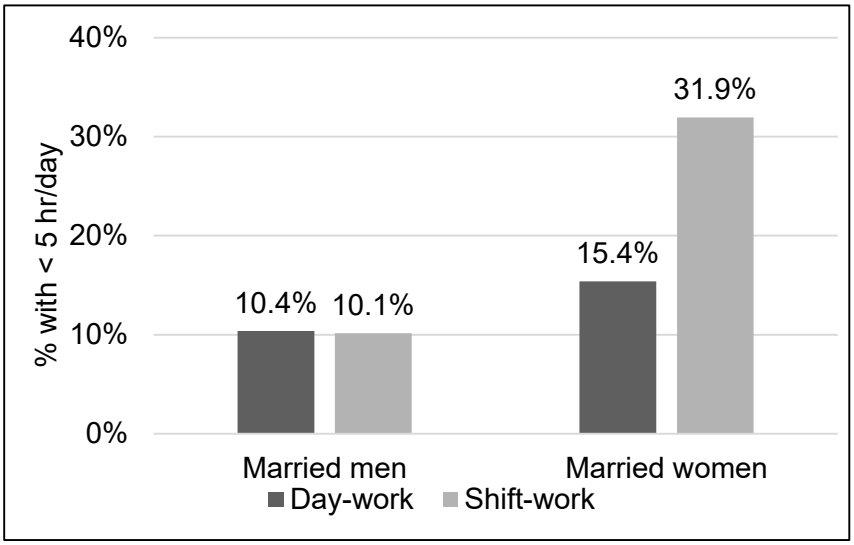


Figure 3. Distribution of short sleep duration (<5 hr/day) and shiftwork among married participants.



Online resource 1. Conversion table for men and women.

	Calculation formula (Qn: question number)	Rating points	Conversion table for men Favorable ←→ Unfavorable					Conversion table for women Favorable ←→ Unfavorable				
Job stressors			5 pt.	4 pt.	3 pt.	2 pt.	1 pt.	5 pt.	4 pt.	3 pt.	2 pt.	1 pt.
Quantitative job overload	15-(Q1+Q2+Q3)	2 pt.	3~5	6~7	8~9	10~11	12	3~4	5~6	7~9	10~11	12
Qualitative job overload	15-(Q4+Q5+Q6)	3 pt.	3~5	6~7	8~9	10~11	12	3~4	5~6	7~8	9~10	11~12
Physical demands	5-Q7	2 pt.		1	2	3	4		1	2	3	4
Interpersonal conflict	10-(Q12+Q13)+Q14	1 pt.	3	4~5	6~7	8~9	10~12	3	4~5	6~7	8~9	10~12
Poor physical environment	5-Q15	2 pt.		1		3	4	1		2	3	4
Job control	15-(Q8+Q9+Q10)	2 pt.	3~4	5~6	7~8	9~10	11~12	3	4~5	6~8	9~10	11~12
Skill utilization	Q11	2 pt.	1	2	3	4		1	2	3	4	
Suitable jobs	5-Q16	1 pt.	1	2	3		4	1	2	3		4
Intrinsic rewards	5-Q17	1 pt.	1	2	3		4	1	2	3		4
	Total	16 pt.										
Stress Response			5 pt.	4 pt.	3 pt.	2 pt.	1 pt.	5 pt.	4 pt.	3 pt.	2 pt.	1 pt.
Vitality	Q18+Q19+Q20	2 pt.	3	4~5	6~7	8~9	10~12	3	4~5	6~7	8~9	10~12
Irritability	Q21+Q22+Q23	1 pt.	3	4~5	6~7	8~9	10~12	3	4~5	6~8	9~10	11~12
Fatigue	Q24+Q25+Q26	2 pt.	3	4	5~7	8~10	11~12	3	4~5	6~8	9~11	12
Anxiety	Q27+Q28+Q29	3 pt.	3	4	5~7	8~9	10~12	3	4	5~7	8~10	11~12
Depressive feeling	Add all Q30-Q35	3 pt.	6	7~8	9~12	13~16	17~24	6	7~8	9~12	13~17	18~24
Somatic symptoms	Add all Q36-Q46	2 pt.	11	12~15	16~21	22~26	27~44	11~13	14~17	18~23	24~29	30~44
	Total	13 pt.										
Buffering factors			5 pt.	4 pt.	3 pt.	2 pt.	1 pt.	5 pt.	4 pt.	3 pt.	2 pt.	1 pt.
Support from supervisor	15-(Q47+Q50+Q53)	4 pt.	3~4	5~6	7~8	9~10	11~12	3	4~5	6~7	8~10	11~12
Support from coworkers	15-(Q48+Q51+Q54)	4 pt.	3~5	6~7	8~9	10~11	12	3~5	6~7	8~9	10~11	12
Support from family and friends	15-(Q49+Q52+Q55)	2 pt.	3~6	7~8	9	10~11	12	3~6	7~8	9	10~11	12
	Total	10 pt.										
Job and life satisfaction	10-(Q56+Q57)	4 pt.	2~3	4	5~6	7	8	2~3	4	5~6		

An example of conversion in men is shown in circles and rating points. High stress is determined by using rating points except for Job and life satisfaction.

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