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Original Article

The association of long working hours and short sleep duration on mental health among Japanese physicians

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Abstract: This cross-sectional study investigates the association between long working hours, short sleep duration, and mental health among Japanese physicians. We enrolled 232 Japanese physicians. We used the Brief Job Stress Questionnaire to assess high-stress status, and the Japanese version of the Center for Epidemiologic Studies Depression scale to assess depressive status. Daily sleep duration (DSD) and weekly working hours (WWHs) were collected using a self-administered questionnaire. Multivariable-adjusted logistic regression analysis was performed to examine the association of the combined categories of DSD and WWHs with high-stress and depressive status. Compared to physicians with WWHs <80 h and DSD ≥6 h, the multivariable-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of high-stress status for those with WWHs ≥80 and DSD ≥6, WWHs <80 and DSD <6, and WWHs ≥80 and DSD <6 were 2.76 (0.97–7.87), 3.36 (1.53–7.40), and 3.92 (1.52–10.14), respectively. The respective ORs (CIs) of depressive status were 1.82 (0.42–7.81), 4.03 (1.41–11.53), and 4.69 (1.33–16.62). The results showed that regardless of working long hours or not, physicians with DSD <6 h had significantly higher stress and depressive status, suggesting that not only regulating long working hours but also ensuring adequate sleep duration is important for preventing physicians' mental health.

Key words: Physicians, Mental health, Long working hours, Short sleep duration, Cross-sectional study

Introduction

Long working hours have been one of the most important topics in occupational health since the late 19th century[1]. Although long working hours are assumed to be an inevitable part of a career in medicine[2], previous studies have shown that long working hours have a negative impact on the mental health of physicians. A systematic review of the factors associated with burnout among physicians demonstrated that long working hours are a predictor of burnout[3]. In addition, Australian junior doctors who worked over 55 h/wk were more than twice as likely to report common mental disorders and suicidal ideation as those working 40–44 h/wk[2]. Also, a prospective cohort study showed that Japanese residents who worked 80–100 h/wk had 2.83 fold higher risk, and those

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who worked ≥100 h/wk had a 6.96-fold higher risk of developing depressive symptoms, compared with those who worked <60 h/wk[4].

However, an association between long working hours and mental health remains unclear. A meta-analysis of prospective studies suggested that although long working hours were associated with the onset of depressive symptoms, the association varied between countries; that is, the association in Europe was relatively smaller than that in Asia[5]. Additionally, a systematic review reported that working overtime was associated with a non-significant elevated risk of depressive disorders among adult workers employed by a company or organization[6].

A potential reason for this discrepancy is sleep duration. Sleep deprivation may be caused by long working hours, sleep problems, or simply by spending less time in bed[7]. Previous cross-sectional studies among general workers have suggested that mental health problems associated with long working hours are the result of short sleep duration[8, 9].

However, no studies have examined the association between the combination of long working hours and sleep duration, and mental health among physicians[10]. Regarding Japanese physicians, the upper limit on working hours will be applied from April 2024[11]; therefore, further research on working hours, sleep duration, and mental health is required not only to prevent mental health problems among physicians but also to implement evidence-based policies.

Therefore, this cross-sectional study aimed to examine the association of the combination of working hours and sleep duration with mental health including stress response and depressive status among Japanese physicians.

Subjects and Methods

Participants

We recruited physicians who worked at hospitals belonging to the Association of Japan Medical Colleges and the Council of Four Hospital Organizations. A total of 307 physicians from 18 hospitals participated in the study. Of these physicians, we excluded those with incomplete data on age (n=1), postgraduate years (n=2), weekly working hours (WWHs) (n=43), daily sleep duration (DSD) (n=7), Brief Job Stress Questionnaire (BJSQ) (n=3) and Center for Epidemiologic Studies Depression (CES-D) scale (n=16), and those who answered working hours of ≥120 h/wk as outliers (n=3). In total, 232 physicians were included in the analysis. The study protocol was approved by the Ethics Committee of the Juntendo University Graduate School of Medicine, and informed consent was obtained from each physician.

Questionnaires and variables

We used the BJSQ and Japanese version of the CES-D scale to assess mental health. The BJSQ, widely used in Japan[10] to assess job stress, contains 57 items classified into three categories: job stressors (17 items), psychological and physical stress reactions (29 items), and support for workers (11 items). In this study, psychological and physical stress reactions were converted using the raw score conversion table, and the converted total score ranges from 6–30[12]. Although a lower score indicates greater stress and a psychological and physical stress score ≤12 represents a high-stress status[13], the number of physicians with a score ≤12 was too small (n=11) in this study. Therefore, we divided the psychological and physical stress score into quartiles, and defined the lowest quartile (6–16) as "high-stress status". The CES-D Scale, which is widely used as a clinical screening tool for the presence of depressive symptomatology[14], is a 20-item self-rated questionnaire assessing the frequency of depressive symptoms experienced over the past week. Each item was scored on a 4-point ordinal scale ranging from 0 to 3. The CES-D total score ranges from 0 to 60 and CES-D score ≥20 was defined as the presence of depressive status[15]. A self-administered questionnaire was used to assess WWHs, DSD, and other covariates. We divided WWHs into two categories; <80 and ≥80 h/wk, because according to the Japanese Medical Care Act, the maximum overtime working hours for Japanese physicians after 2024 will be about 1,860 h/yr which is equivalent to 155 h/month, or approximately 40 h/wk. Thus, WWHs of 80 h are equivalent to the normal 40 h/wk plus 40 h of overtime. The average amount of DSD on workdays in the past month was also assessed and categorized into two categories; DSD of <6 and ≥6 h according to the previous studies which showed sleep duration of <6 h was a significant risk factor for mental distress[16]. Moreover, the combinations of WWHs (<80 and ≥80) and DSD (<6 and ≥6 h) were recategorized into the following four groups; WWHs <80 h and DSD ≥6 h, WWHs ≥80 h and DSD ≥6 h, WWHs <80 h and DSD <6 h and WWHs ≥80 h and DSD <6 h.

We collected data on age (yr), sex (men and women), postgraduate years (yr), and hospital type (university hospitals and others) as covariates.

Statistical analysis

The characteristics of the participants were tested using the Kruskal–Wallis test for continuous variables and the chi-square test for categorical variables. A multivariable-adjusted logistic regression analysis was performed to examine the association of the combined categories of working hours and sleep duration with high stress and depression after adjusting for sex, age, and hospital type. All probability values for statistical tests were two-tailed, and values of $p<0.05$ were regarded as statistically significant. All analyses were performed using SAS software (version 9.4; SAS Institute, Inc., Cary, NC, USA).

Results

Table 1 shows the characteristics of participants according to the combinations of WWHs and DSD. The mean scores of the psychological and physical stress reactions and the proportion of physicians who worked at university hospitals were significantly different between the combination category of WWHs and DSD, but there were no significant differences among the four groups in terms of age, postgraduate years, and CES-D score.

Table 2 shows the associations of the combination category of WWHs and DSD with high-stress status. Compared to physicians with WWHs <80 h and DSD ≥6 h, the multivariable-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of high-stress status for those with WWHs ≥80 and DSD ≥6, WWHs <80 and DSD <6 and WWHs ≥80 and DSD <6 were 2.76 (0.97–7.87; $p=0.06$), 3.36 (1.53–7.40; $p<0.01$) and 3.92 (1.52–10.14; $p<0.01$), respectively.

Table 3 shows the associations of the combination category of WWHs and DSD with depressive status. Compared to physicians with WWHs <80 h and DSD ≥6 h, the multivariable-adjusted ORs (95% CIs) of depressive status for those with WWHs ≥80 and DSD ≥6, WWHs <80 and DSD <6 and WWHs ≥80 and DSD <6 were 1.82 (0.42–7.81; $p=0.42$), 4.03 (1.41–11.53; $p<0.01$), 4.69 (1.33–16.62; $p=0.02$), respectively.

Discussion

In this study, we investigated the association of work-

Table 1. Characteristics of participants according to the combination category of WWHs and DSD

WWHs DSD	<80 h ≥6 h	≥80 h ≥6 h	<80 h <6 h	≥80 h <6 h	*p*-value[a]
N (M/F)	118 (100/18)	25 (18/7)	59 (51/8)	30 (26/4)	
Age, yr[b]	41.0 (8.9)	38.8 (9.8)	42.6 (8.4)	39.3 (8.7)	0.17
Work week, h[b]	57.2 (9.4)	84.3 (6.2)	62.0 (9.9)	86.6 (6.7)	<0.01
Sleeping duration, h[b]	6.4 (0.6)	6.3 (0.7)	5.0 (0.5)	4.9 (0.4)	<0.01
postgraduate years, yr[b]	15.3 (8.7)	13.8 (10.0)	17.6 (8.7)	13.8 (8.2)	0.13
University-based hospital, n (%)	59 (50.0)	12 (48.0)	38 (64.4)	27 (90.0)	<0.01
Psychological and physical stress reactions score, points[b]	20.5 (4.3)	19.8 (4.1)	18.5 (4.1)	17.7 (4.8)	<0.01
CES-D, points[b]	9.1 (6.5)	9.6 (6.2)	11.3 (9.1)	13.0 (9.6)	0.27

[a]Kruskal–Wallis test for continuous variables and χ^2 test for categorical variables.

[b]Data is shown as mean (standard deviation).

CES-D: Center for Epidemiologic Studies Depression; DSD: daily sleep duration; M/F: Male/Female; WWHs: weekly working hours.

Table 2. The associations of the combination category of WWHs and DSD with high-stress status

WWHs	<80 h	≥80 h		<80 h		≥80 h	
DSD	≥6 h	≥6 h		<6 h		<6 h	
N	118	25		59		30	
High stress status, n (%)	16 (13.6)	7 (28.0)		19 (32.0)		12 (40.0)	
	Reference	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Crude	1.00	2.48 (0.89–6.87)	0.08	3.03 (1.42–6.47)	<0.01	4.25 (1.73–10.46)	<0.01
Model I	1.00	2.50 (0.89–7.02)	0.08	3.13 (1.46–6.73)	<0.01	4.11 (1.66–10.15)	<0.01
Model II	1.00	2.76 (0.97–7.87)	0.06	3.36 (1.53–7.40)	<0.01	3.92 (1.52–10.14)	<0.01

Model I: adjusted for age and sex, Model II: multivariable-adjusted for age, sex, and hospital type.

CI: confidence interval; DSD: daily sleep duration; OR: odds ratio; WWHs: weekly working hours.

Table 3. The associations of the combination category of WWHs and DSD with depressive status

WWHs	<80 h	≥80 h		<80 h		≥80 h	
DSD	≥6 h	≥6 h		<6 h		<6 h	
N	118	25		59		30	
Depressive status, n (%)	7 (5.9)	3 (12.0)		11 (18.6)		6 (20.0)	
	Reference	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Crude	1.00	2.16 (0.52–9.02)	0.29	3.63 (1.33–9.94)	0.01	3.96 (1.22–12.85)	0.02
Model I	1.00	1.89 (0.44–8.04)	0.38	3.89 (1.40–10.80)	<0.01	4.03 (1.23–13.22)	0.02
Model II	1.00	1.82 (0.42–7.81)	0.42	4.03 (1.41–11.53)	<0.01	4.69 (1.33–16.62)	0.02

Model I: adjusted for age and sex, Model II: multivariable-adjusted for age, sex, and hospital type.
CI: confidence interval; DSD: daily sleep duration; OR: odds ratio; WWHs: weekly working hours.

ing hours and sleep duration with mental health including high-stress status and depressive status among Japanese physicians. The results showed that regardless of long working hours, physicians with DSD <6 h exhibited significantly higher stress and depressive status compared to those with WWHs <80 h and DSD ≥6 h. Various studies have been conducted on the association between physicians' long working hours and mental health such as stress and depression[2, 10, 17–20], but few studies have considered the mediating role of sleep duration in the relationship between long working hours and mental health among physicians. A previous study showed that having no days off duty per month, being on call 8 times or more per month, averaging less than 5 h of sleep per night not doing overnight work, and working overnight 6 or more times per month were each associated with depressive status among Japanese physicians[21]. Additionally, a cross-sectional study of 2,643 full-time employees of small- and medium-scale companies in Japan found that depression associated with long working hours was primarily a result of sleep deprivation[8]. Another cross-sectional study of 3,559 employees from 17 companies in Tokyo showed the effect of overtime on psychosomatic stress due to short sleep duration[9]. Additionally, a cross-sectional study of Taiwanese healthcare workers, including physicians, found that working hours were associated with burnout, and the association was partially mediated by sleep hours[22]. These results are consistent with our findings, that physicians with a sleep duration of <6 h were associated with mental health, irrespective of long working hours.

For many years, long working hours were assumed to be an inevitable part of a career in medicine[2]. However, physicians' working hours are being reconsidered in many countries because of increasing concerns about the potential impact of extended working hours on mental health and decreased performance associated with fatigue[2]. In recent years, many countries have legislated specific work-hour restrictions for junior doctors, such as the 48 h maximum workweek introduced under the European Working Time Directive in Europe in 2000 and an 80-h workweek for all US residents instituted by the Accreditation Council for Graduate Medical Education (ACGME) in July 2011[2]. Subsequently, the ACGME announced changes in 2017 to allow first-year residents to work shifts lasting up to 24 h, with up to an additional 4 h for care transition[23]. In Japan, since April 1, 2020, "The Work Style Reform Bill" has been applied to all professionals except for a few, including physicians, considering their current working hours. The upper limit on working hours for physicians will be applied from April 2024 and is expected to be 1,860 h/yr, which is far more than that of general employees[11]. Therefore, measures to prevent physical and mental health problems among physicians who are exposed to long working hours are needed. However, even though the regulation of working hours has been implemented among physicians and general employees, a system to ensure adequate sleep duration has not been prepared. Our findings suggest that not only regulating long working hours but also ensuring adequate sleep duration is important for preventing mental health among Japanese physicians. Furthermore, "Manual on Health Security Measures for Physicians Who Work Long Hours (Revised Edition)" published by the Ministry of Health, Labour and Welfare in preparation for the regulation of upper limits on physicians' overtime work recommends securing at least 6 h of sleep duration[24]. Our findings also support the recommendation.

This study has some limitations. First, this study had a cross-sectional design and could not prove the causality of long working hours and sleep duration with mental health. However, previous studies have shown that long working hours and short sleep duration may be risk factors for mental health[2–6, 8, 9, 21]. Thus, the combination of WWHs and DSD may be a risk factor for mental health problems. Second, we collected data on WWHs, DSD, and mental

health using a self-administered questionnaire. Therefore, misclassification is possible. Further studies using objective measurements of these variables are warranted. Third, the physicians who participated in this study were recruited on a voluntary basis; therefore, the representativeness of this study population cannot be guaranteed, and the generalization of these findings to other populations should be made with caution. Fourth, we defined high-stress status by using the first quartile of the psychological and physical stress score, instead of using the cut-off score of ≤12, which is the definition of high stress when using the raw score conversion table of BJSQ. This may overestimate the association between working hours and sleep duration and high-stress status. Finally, although we examined the association of WWHs and DSD with mental health after adjusting for potential confounding factors, there might be residual confounders, such as social factors, including marital status and family structure[25], and history of mental health. Further studies are required to address this issue.

This cross-sectional study found that physicians with short sleep duration were more likely to have a high-stress and depressive status, irrespective of having long working hours. Further large-scale longitudinal studies are needed to elucidate the significance of adequate sleep duration in protecting the mental health of physicians who work long hours.

Author's Contributions

YM analyzed the data and wrote the first draft. KT supervised and interpreted the data. HW interpreted data and critically revised the manuscript. ME acquired the funding and organized the survey. SS collected and interpreted the data. KT acquired the funding, organized the survey and critically revised the manuscript. TT supervised and conceptualized the study. All the authors agree with the final version of the manuscript.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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