Association of Current Work and Sleep Situations with Excessive Daytime Sleepiness and Medical Incidents among Japanese Physicians

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Objective: The aim of the present study was to clarify the current work and sleep situations of physicians in Japan and to clarify the association between these situations and excessive daytime sleepiness as well as medical incidents.

Methods: A self-administered questionnaire survey was conducted among the members of the Japan Medical Association in 2008. The randomly selected subjects comprised 3,000 male physicians and 1,500 female physicians.

Results: Valid responses were obtained from 3,486 physicians (2,298 men and 1,188 women). Mean sleep duration was 6 h 36 min for men and 6 h 8 min for women. The prevalence of lack of rest due to sleep deprivation was 30.4% among men and 36.6% among women; the prevalence of insomnia was 21.0% and 18.1%, respectively; and the prevalence of EDS was 3.5%. The adjusted odds ratio for EDS was high for physicians who reported short sleep duration, lack of rest due to

sleep deprivation, and a high frequency of on-call/overnight work. Physicians who had experienced a medical incident within the previous one month accounted for 19.0% of participants. The adjusted odds ratio for medical incidents was high for those subjected to long working hours, high frequency of on-call/overnight works, lack of rest due to sleep deprivation, and insomnia.

Conclusion: In order to facilitate optimal health management for physicians as well as securing medical safety, it is important to fully consider the work and sleep situations of physicians.

Keywords: Physicians, sleep duration, insomnia, excessive daytime sleepiness, medical incidents

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It has been reported that long work hours and sleep deprivation affect both mental state and physical function, causing excessive daytime sleepiness and a decline in cognitive function.¹⁻⁶ Therefore, from the dual viewpoint of health maintenance among the workforce and the safe management of the workplace, it is necessary in occupational health practice to avoid assigning excessive work hours so that adequate sleep durations are ensured. Particularly, as overwork and sleep deprivation in physicians can directly result in medical incidents, it is essential to investigate the actual situation concerning this issue and take appropriate measures toward ensuring medical safety.

Some epidemiological studies have investigated the work and sleep situations of physicians. A study conducted on 2,737 medical residents in the US reported that as extended-duration work shifts of the medical residents increased, there was a reduction in the duration of sleep available to them, leading to an increase in the number of medical errors.⁷ Another study of 3,604 medical residents in the US showed that long work hours and short sleep duration were associated with medical errors and trouble with colleagues.⁸ A Japanese study of 102 medical residents working in a university hospital revealed that sleep duration and working hours showed a strong inverse association with each other, and that short sleep durations were associated with daytime dozing.⁹ In addition, the reduction in the number of working hours of medical interns led to a decrease in the number of serious medical errors and attentional failures in intensive care units.^{10,11}

BRIEF SUMMARY

Current Knowledge/Study Rationale: The work and sleep situations of physicians are important from the viewpoint of health management as also for ensuring medical safety. In this study, we surveyed randomly selected physicians located throughout Japan in order to clarify their current work and sleep situations, and studied the association of these situations with excessive daytime sleepiness and medical incidents.

Study Impact: The excessive daytime sleepiness and medical incidents encountered by Japanese physicians were closely associated with both their work situation and their sleep status. To provide adequate health management for physicians and to improve medical safety, it is important that adequate attention be paid to physicians' work and sleep.

Most of the previous studies of the work and sleep situations of physicians involved mainly medical residents, and only rarely physicians in general. However, as the issue of work and sleep among physicians is not limited to medical residents, it should be addressed using samples representing the population of employed physicians as a whole. Furthermore, as it is known that the number of physicians per capita in Japan is less than that in other developed countries such as the US and Europe,¹² one could assume that Japanese physicians are more likely to be subject to overwork and, consequently, sleep deprivation. Against this background, we surveyed randomly selected physicians located throughout Japan to clarify their current work and sleep situations, and we studied the associa-

tion of these situations with excessive daytime sleepiness and medical incidents.

METHODS

Survey Method

In this study, we used data collected in our previous survey conducted in 2008 on the lifestyle habits of members of the Japan Medical Association (JMA). This survey was conducted jointly by the JMA and the Division of Public Health, Department of Social Medicine, Nihon University School of Medicine. For implementation of the survey, approval was obtained beforehand from the Board of Directors of the JMA.

The study subjects were 3,000 male and 1,500 female physicians selected randomly from among the 141,313 male and 22,859 female physicians who were members of the JMA in April 2008 (about 60% of all physicians in Japan). Four items were distributed by mail to the subjects: a self-administered questionnaire, a letter requesting cooperation in the survey, a medium-sized return envelope, and a small envelope for enclosing the questionnaire. Each subject was asked to enclose the completed questionnaire in the small envelope and seal it, then place it in the medium-sized return envelope for return to the JMA. No incentives, such as recompense or gifts, were offered to the participants for cooperating in the survey, and the subjects participated at their own free will only. To identify those who did not return questionnaires, a label bearing the subject's name and address was attached to the medium-sized return envelope. No name or address was to be written on the questionnaire or the small envelope. Only the person in charge of the survey at the JMA was allowed to open the medium-sized envelope and take out the small envelope containing the questionnaire. The empty medium-sized envelopes and the small envelopes containing the questionnaires were then kept separately. All the collected small envelopes were transported to the Division of Public Health, Department of Social Medicine, Nihon University School of Medicine, where they were opened and the enclosed questionnaires were removed and used for the analysis. This process ensured that personal data and the completed questionnaires were separated, to protect the privacy of the respondents. Details of this privacy-protection policy and process were also explained to the subjects in the questionnaire. Those who did not return questionnaires were identified from the list of subjects and the labels attached to the medium-sized return envelopes. A second package was sent to the subjects who had not returned a questionnaire, again seeking their cooperation. This follow-up procedure was repeated up to 3 times. The survey was conducted from May to October 2008.

Survey Items

The questionnaire consisted of questions pertaining to the following nine issues: (1) basic attributes: sex, age, employment status, institution, department; (2) work status: work hours, the number of off-duty days, the number of days of on-call/overnight work; (3) sleep situation: sleep duration, sufficiency level of rest obtained through sleep, difficulty initiating sleep, difficulty maintaining sleep, and early morning awakening; (4) excessive daytime sleepiness; (5) experience of medical

incidents; (6) smoking habits; (7) drinking habits; (8) exercise habits; and (9) mental state.

Specific questions related to work hours, the number of days off duty, and sleep duration included the following:

- Work hours: "How many hours per day did you work in the past month on average?"
- The number of days off duty: "How many days did you take off work in the past month?"
- Sleep duration: "On average, how many hours of sleep do you get per night?"

To answer the above questions, the respondents were asked to enter specific numerical values.

With regard to the issues of on-call/overnight work, the sufficiency level of rest obtained through sleep, difficulty initiating sleep, difficulty maintaining sleep, early morning awakening, and excessive daytime sleepiness, information was collected by asking the respondents to choose one of various response options. The specific questions and the response options (in parentheses) were as follows:

The number of days of on-call/overnight work: "Do you have on-call/overnight work duty?" (1 = Never; 2 = Approximately once every few months; 3 = Approximately once every month; 4 = Approximately 2-3 times per month; 5 = Approximately 4-7 times per month; 6 = Eight times or more per month)

Sufficiency level of rest obtained by sleep: "How much rest through sleep do you feel that you get?" (1 = Enough; 2 = Reasonably sufficient; 3 = Insufficient; 4 = None at all; 5 = Not sure)

As for the question about the sufficiency level of rest obtained through sleep, respondents who chose either option 3 or 4 were identified as lack of rest due to sleep deprivation.

Difficulty initiating sleep: "Do you have difficulty in falling asleep at night?" (1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Always)

Difficulty maintaining sleep: "Do you wake at night and have difficulty in falling asleep again?" (1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Always)

Early morning awakening: "Do you wake up too early in the morning and have difficulty in falling asleep again?" (1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Always)

"Often" and "always" were taken as affirmative answers to the question. The presence of difficulty initiating sleep, difficulty maintaining sleep, or early morning awakening, respectively, was defined when an affirmative answer was obtained.

Insomnia was defined as being present when an affirmative answer was obtained for any of the 3 questions.

Excessive daytime sleepiness: "Do you find yourself excessively sleepy during the daytime and unable to prevent yourself from falling asleep when you must not sleep?" (1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Often; 5 = Always)

"Often" and "always" were taken as affirmative answers to the question.

The term "medical incident" refers to a case in which incorrect medical practice has been discovered before it is implemented, or in which incorrect medical practice has been implemented but without adversely affecting the patient concerned. In other words, these are cases of medical error, which luckily have had no serious consequences. This type of situation or incident is referred to as *hiyari hatto* in Japanese, a term

Table 1—Basic attributes of the participants

	N	%
Overall	3486	100.0
Sex		
Male	2298	65.9
Female	1188	34.1
Age Group, y		
20-39	381	10.9
40-49	854	24.5
50-59	984	28.2
60-69	552	15.8
70+	715	20.5
Employment Status		
Employers	1860	53.4
Employees	1555	44.6
Unknown	71	2.0
Institution		
Clinic	2151	61.7
Hospital	1128	32.4
Other	165	4.7
Unknown	42	1.2
Department		
Internal Medicine	1502	43.1
Surgery	356	10.2
Orthopedics	262	7.5
Pediatrics	470	13.5
Obstetrics & Gynecology	248	7.1
Psychiatry	161	4.6
Dermatology	223	6.4
Urology	70	2.0
Ophthalmology	261	7.5
Otorhinolaryngology	156	4.5
Other	412	11.8

coined to express the sense of surprise and frustration resulting from such a situation. Further detailed information regarding any medical incidents that have occurred is reported to the parties concerned, is shared among a wide range of medical staff, and is used effectively to prevent future medical errors. In this study, the following questions related to the actual experience of *hiyari hatto* were asked: “Did you experience any *hiyari hatto* by virtue of being on the verge of making a mistake at work in the past one month?” Four response options (1 = Never; 2 = Seldom; 3 = Sometimes; 4 = Often) were prepared, and the respondents who chose response options 3 or 4 were identified as having experienced a medical incident.

Statistical Analysis

First, with regard to work status, we calculated the mean number of working hours and the number of days off duty for each item of the basic attributes including sex, age, employment status, institution, and department. Also, the responses to the question about the number of days of on-call/overnight work were summed for each of the basic attributes. Second, with regard to the physicians’ sleep situations, we calculated the

mean sleep duration, the prevalence of lack of rest due to sleep deprivation, and the prevalence of insomnia for each item of the basic attributes and work status. Thirdly, we calculated the prevalences of excessive daytime sleepiness and the proportion of people who had experienced a medical incident (the prevalence of medical incidents) for each item of the basic attributes, work status, and sleep status. To study the statistical significance of the results, we used analysis of variance for continuous numerical data and the χ^2 test for categorical data. For the analysis of departments, we examined the differences between the group of physicians who, in the questionnaire, selected one department as their specialty (or one of their specialties) and the group of physicians who did not select that particular department as their specialty. Finally, we studied the associations of excessive daytime sleepiness and experiences of medical incidents with work status and sleep situation by multiple logistic regression analyses. For this purpose, we prepared 2 models in which excessive daytime sleepiness and experience of a medical incident were each taken as dependent variables, while each item pertaining to work status and sleep situation was used as an independent variable. Furthermore, we adjusted for confounding variables by using each of the basic attributes such as sex, age group, employment status, and institution as a co-variable.

RESULTS

Among the 4,500 persons sampled, 42 were excluded as they were unable to respond due to hospitalization/death/migration abroad for study purposes, or because the questionnaire could not be delivered due to change of address. Thus, the number of persons who actually received the questionnaire totaled 4,458. The number of collected questionnaires (percentage of the collected questionnaires in the number of questionnaires actually received by the subjects) was 2,458 (55.1%) in the first round of mails, 618 (13.9%) in the second round of mails, 293 (6.6%) in the third round of mails, and 192 (4.3%) in the fourth round of mails. The total number of collected questionnaires was 3,561, and the eventual response rate was 79.9%. Of these, 75 questionnaires were excluded because of omission of required data such as age and sex; thus 3,486 responses (2,298 men and 1,188 women) were finally considered valid for the proposed statistical analysis.

Table 1 shows the basic attributes of the participants. With regard to employment status, more than 50% had an independent medical practice; for the institutions where the physicians practiced, more than 60% worked in a clinic.

Table 2 shows the mean number of hours worked per day and the mean number of off-duty days per month. For the respondents as a whole, the mean period worked per day was 512 min (8 h 32 min). Male physicians, young physicians, employees, and physicians who worked in hospitals tended to work longer. The working hours of surgeons were significantly longer than those of all other physicians. Likewise, the working hours of orthopedists were also significantly longer. For the respondents as a whole, the mean number of off-duty days was 5.8. Male physicians, physicians under the age of 70, employers, and physicians who worked in hospitals tended to have fewer days off duty. On the contrary, the number of days off duty was higher for physicians in the “other category” of insti-

Table 2—Work hours and days off duty among Japanese physicians

	Work Hours Per Day, min				Number of Days Off Duty Per Month			
	N	Mean	SD	p-value*	N	Mean	SD	p-value*
Overall	3240	512.0	164.1		3299	5.8	3.5	
Sex				< 0.01				< 0.01
Male	2145	528.5	163.6		2194	5.5	3.5	
Female	1095	479.6	160.2		1105	6.4	3.5	
Age Group, y				< 0.01				< 0.01
20-39	357	566.1	160.9		372	5.5	3.4	
40-49	809	551.3	143.0		838	5.3	2.5	
50-59	943	548.1	132.0		967	5.2	2.6	
60-69	520	516.4	136.3		536	5.6	2.9	
70+	611	368.8	178.0		586	7.7	5.4	
Employment Status				< 0.01				< 0.01
Employers	1736	499.2	151.3		1782	5.5	3.0	
Employees	1464	535.5	167.2		1492	6.0	3.8	
Institution				< 0.01				< 0.01
Clinic	2002	485.8	152.4		2043	5.7	3.2	
Hospital	1067	577.7	154.0		1096	5.5	3.5	
Other	147	423.9	209.6		143	8.2	5.9	
Department								
Internal Medicine	1403	504.1	159.6	0.02	1429	5.8	3.5	0.71
Surgery	329	539.7	166.1	< 0.01	336	5.2	3.1	< 0.01
Orthopedics	247	537.3	155.7	0.01	249	5.5	4.1	0.15
Pediatrics	438	488.3	159.8	< 0.01	442	5.5	3.3	0.06
Obstetrics & Gynecology	226	521.4	190.5	0.37	230	5.1	3.7	< 0.01
Psychiatry	155	525.5	155.6	0.29	153	6.4	3.0	0.02
Dermatology	205	479.3	148.1	< 0.01	211	6.1	3.4	0.14
Urology	66	536.4	146.9	0.22	68	4.9	2.7	0.05
Ophthalmology	231	446.3	144.4	< 0.01	238	6.9	3.7	< 0.01
Otorhinolaryngology	149	473.8	150.0	< 0.01	146	6.2	2.8	0.11

In each section, the missing data have been excluded from the statistical analyses. *Analysis of variance; SD, standard deviation.

tutions. This category included physicians working for government institutions (such as the Ministry of Health, Labour, and Welfare) and health centers and welfare institutions, such as nursing homes and health care facilities. Surgeons and obstetricians/gynecologists had significantly fewer days off duty than others. The number of off-duty days for ophthalmologists was significantly higher than the others.

Table 3 shows the on-call/overnight work situations. Male physicians, young physicians, employees, and physicians who worked in hospitals tended to have a higher number of days of on-call/overnight work than the others. With regard to department, > 20% of surgeons were on-call/worked overnight ≥ 4 times per month. Among pediatricians, the proportion of respondents who fell under the category of either “once every few months” or “once a month” of on-call/overnight work amounted to > 10%. The number of days of on-call/overnight work assigned to obstetricians/gynecologists was significantly high, ≥ 4 times for > 40% of those surveyed; 23% were on-call/worked overnight ≥ 8 times per month. Among dermatologists, ophthalmologists, and otorhinolaryngologists, $\geq 80\%$ did not work on-call/overnight.

Table 4 shows the data for sleep status. The mean duration of sleep available per day to Japanese physicians was found to be approximately 380 min (6 h 20 min). Women showed shorter sleep duration than men. By age group, physicians in their 40s had the lowest average sleep duration. Also, employees and those working in hospitals had shorter sleep duration. Sleep duration tended to become shorter in inverse proportion to working hours. Linear regression analysis indicated an association such that the sleep duration became shorter by 6.2 min as the working hours became longer by 1 h (data not shown). An additional tendency was observed for sleep duration to become shorter as the number of days of on-call/overnight work increased. Furthermore, it was observed that physicians having fewer days off duty tended to have shorter sleep durations. The prevalence of lack of rest due to sleep deprivation was 32.5% for the study subjects as a whole and was higher among women, young physicians, employees, and those working in hospitals. The number of respondents reporting lack of rest due to sleep deprivation increased as working hours became longer, as the number of days of on-call/overnight work increased, or as the number of days off duty decreased. Insomnia was observed in 20.0% of all respondents, and

Table 3—Number of days of on-call/overnight work among Japanese physicians

	N	Number of Days of On-Call/Overnight Work						p-value*
		Never	once every few months	once every month	2 to 3 times per month	4 to 7 times per month	8 times per month or more	
Overall	3414	67.2	6.0	6.0	7.6	8.0	5.2	
Sex								< 0.01
Male	2250	63.6	7.0	6.1	8.0	9.2	6.2	
Female	1164	74.0	4.1	5.9	6.9	5.8	3.3	
Age Group, y								< 0.01
20-39	376	44.1	3.2	4.8	17.6	20.7	9.6	
40-49	849	58.5	6.2	8.8	12.4	9.4	4.6	
50-59	976	65.3	7.9	7.6	5.1	8.2	5.9	
60-69	544	74.4	7.4	5.3	3.9	3.7	5.3	
70+	669	87.9	3.4	1.5	2.5	2.4	2.2	
Employment Status								< 0.01
Employers	1822	75.0	8.1	5.4	3.0	3.3	5.3	
Employees	1539	57.1	3.7	7.0	13.2	13.8	5.3	
Institution								< 0.01
Clinic	2106	77.9	6.9	5.2	2.5	2.7	4.8	
Hospital	1118	43.6	4.6	8.4	18.1	18.9	6.5	
Other	162	88.3	3.7	1.2	1.9	3.7	1.2	
Department								
Internal Medicine	1476	69.1	7.6	5.4	6.8	6.6	4.5	< 0.01
Surgery	345	58.0	5.5	5.5	9.3	13.6	8.1	< 0.01
Orthopedics	256	68.0	4.7	4.3	7.4	9.8	5.9	0.62
Pediatrics	463	62.9	10.4	12.3	5.6	5.2	3.7	< 0.01
Obstetrics & Gynecology	236	46.6	3.0	3.8	5.9	17.4	23.3	< 0.01
Psychiatry	160	71.9	3.8	4.4	5.6	10.6	3.8	0.34
Dermatology	220	85.5	5.0	3.6	2.7	0.5	2.7	< 0.01
Urology	68	67.6	5.9	4.4	8.8	8.8	4.4	0.99
Ophthalmology	255	88.6	3.5	3.9	2.4	1.6	0.0	< 0.01
Otorhinolaryngology	153	82.4	7.8	3.9	3.9	0.7	1.3	< 0.01

In each section, the missing data have been excluded from the statistical analyses. *Chi-square test.

its prevalence was high among male physicians and physicians aged ≥ 60 years. A significant association was observed between the number of working hours and the prevalence of insomnia; the prevalence of insomnia was the highest in the category of those who worked < 6 h per day. A significant association was also observed between the number of days off duty and the prevalence of insomnia; the prevalence of insomnia was the highest in the category of those who took < 4 days off per month.

Table 5 shows the responses to the questions about excessive daytime sleepiness and experience of medical incidents. The prevalence of excessive daytime sleepiness was 3.5% among the total respondents and was higher among physicians who were more frequently on-call/worked overnight, those who had shorter sleep durations, those who could not obtain sufficient rest due to sleep deprivation, and those who had insomnia. Among the total respondents analyzed, 19% had experienced a medical incident in the past one month; the prevalence was high among young physicians, employees, and physicians who worked in hospitals. Also, the prevalence of medical incidents was higher among those who worked longer, were on-call/worked overnight

twice per month or more, and those with fewer days off duty. The prevalence of medical incidents was also high among those who reported lack of rest due to sleep deprivation or insomnia.

Table 6 shows the results of multiple logistic regression analysis conducted using either the data for excessive daytime sleepiness or experience of medical incidents as the dependent variable. The adjusted odds ratio for excessive daytime sleepiness was significantly lower among female physicians than among male physicians. In comparison with the adjusted odds ratio for physicians who were never on call/never worked overnight, that for excessive daytime sleepiness was significantly high for physicians who reported being on call/working overnight 2-3 times per month or ≥ 8 times per month. The adjusted odds ratio for excessive daytime sleepiness was also high among those who slept < 6 h per night and those who reported a lack of rest due to sleep deprivation. The adjusted odds ratio for experience of medical incidents was significantly high for ≥ 10 working h, when ≥ 6 and < 8 working h was taken as the reference. In comparison with physicians who were never on call/never worked overnight, the odds ratios for

Table 4—Sleep status among Japanese physicians

	Sleep Duration Per Day, min				Lack of Rest Due to Sleep Deprivation				Insomnia			
	N	Mean	SD	p-value*	N	Pre- valence, %	95% CI	p-value†	N	Pre- valence, %	95% CI	p-value†
Overall	3468	379.8	60.9		3436	32.5	30.9 34.1		3486	20.0	18.7 21.3	
Sex				< 0.01				< 0.01				0.04
Male	2288	386.0	60.6		2266	30.4	28.5 32.3		2298	21.0	19.3 22.7	
Female	1180	367.9	59.7		1170	36.6	33.8 39.4		1188	18.1	15.9 20.3	
Age Group, y				< 0.01				< 0.01				< 0.01
20-39	379	368.8	57.5		378	42.6	37.6 47.6		381	16.5	12.8 20.2	
40-49	851	367.4	53.5		846	40.9	37.6 44.2		854	17.0	14.5 19.5	
50-59	983	373.5	57.4		977	36.9	33.9 39.9		984	20.0	17.5 22.5	
60-69	551	383.8	56.8		544	25.0	21.4 28.6		552	23.2	19.7 26.7	
70+	704	406.4	69.8		691	16.2	13.5 18.9		715	22.9	19.8 26.0	
Employment Status				< 0.01				< 0.01				0.05
Employers	1850	384.9	61.2		1835	30.2	28.1 32.3		1860	21.1	19.2 23.0	
Employees	1549	372.3	58.9		1534	36.1	33.7 38.5		1555	18.4	16.5 20.3	
Institution				< 0.01				< 0.01				0.29
Clinic	2142	384.1	61.6		2124	29.8	27.9 31.7		2151	20.7	19.0 22.4	
Hospital	1124	368.2	55.8		1112	40.4	37.5 43.3		1128	18.7	16.4 21.0	
Other	163	395.3	68.4		162	17.9	12.0 23.8		165	17.6	11.8 23.4	
Work Hours Per Day, h				< 0.01				< 0.01				0.02
< 6 h	386	402.5	71.3		385	15.3	11.7 18.9		388	24.7	20.4 29.0	
≥ 6 h but < 8 h	530	391.3	56.3		524	21.0	17.5 24.5		530	20.2	16.8 23.6	
≥ 8 h but < 10 h	1149	387.2	54.9		1143	27.1	24.5 29.7		1151	17.5	15.3 19.7	
≥ 10 h but < 12 h	736	365.5	52.8		730	43.3	39.7 46.9		737	20.1	17.2 23.0	
≥ 12 h	434	343.3	58.1		432	60.9	56.3 65.5		434	22.6	18.7 26.5	
Number of Days of On-Call/Overnight Work				< 0.01				< 0.01				0.17
Never	2285	385.6	61.6		2273	28.3	26.4 30.2		2293	19.9	18.3 21.5	
once every few months	205	375.7	55.7		205	31.2	24.9 37.5		205	18.0	12.7 23.3	
once every month	206	379.7	54.1		203	33.5	27.0 40.0		206	16.5	11.4 21.6	
2 to 3 times per month	257	361.2	53.4		258	44.2	38.1 50.3		259	20.5	15.6 25.4	
4 to 7 times per month	274	364.0	57.4		272	46.7	40.8 52.6		274	19.3	14.6 24.0	
≥ 8 times per month	177	354.5	58.8		174	48.9	41.5 56.3		177	27.1	20.6 33.6	
Number of Days off Duty Per Month				< 0.01				< 0.01				< 0.01
Less than 4 days	582	353.6	57.8		575	54.4	50.3 58.5		583	24.7	21.2 28.2	
≥ 4 days but < 6 days	1302	376.7	58.7		1296	34.0	31.4 36.6		1304	17.9	15.8 20.0	
≥ 6 days but < 8 days	470	385.2	54.7		468	27.1	23.1 31.1		470	16.6	13.2 20.0	
≥ 8 days but < 10 days	602	387.7	53.7		597	23.5	20.1 26.9		602	19.4	16.2 22.6	
≥ 10 days	338	403.3	68.6		336	17.3	13.3 21.3		340	22.9	18.4 27.4	

In each section, the missing data have been excluded from the statistical analyses. *Analysis of variance; †Chi-square test; SD, standard deviation; CI, confidence interval.

experience of a medical incident were significantly high for those in the on-call/overnight work category of 2-3 times per month or 4-7 times per month. However, in the category of those who worked overnight ≥ 8 times per month, the odds ratio for the experience of a medical incident was not statistically significant. In the category of those who took off ≥ 10 days per month, the odds ratio for the experience of a medical incident was significantly low. Among the respondents who reported lack of rest due to sleep deprivation or insomnia, the adjusted odds ratio for experience of medical incidents was significantly high.

DISCUSSION

Sample Representativeness

This study is the first to have revealed the association of the current work and sleep situations of physicians in Japan with excessive daytime sleepiness and medical incidents. The study had three main features: First, it was conducted nationwide. Second, the survey sample comprised persons who were selected randomly from among members of the JMA without regard to specific age groups, departments, or institutions. Third, the

Table 5—Excessive daytime sleepiness and experience of medical incidents among Japanese physicians

	Excessive Daytime Sleepiness					Experience of Medical Incidents				
	N	Prevalence,%	95% CI		p-value*	N	Prevalence,%	95% CI		p-value*
Overall	3486	3.5	2.9	4.1		3435	19.0	17.7	20.3	
Sex					0.08					0.45
Male	2298	3.9	3.1	4.7		2271	19.4	17.8	21.0	
Female	1188	2.8	1.9	3.7		1164	18.3	16.1	20.5	
Age Group, y					0.20					< 0.01
20-39	381	5.2	3.0	7.4		379	23.0	18.8	27.2	
40-49	854	3.9	2.6	5.2		848	22.8	20.0	25.6	
50-59	984	3.5	2.4	4.6		977	19.8	17.3	22.3	
60-69	552	2.4	1.1	3.7		550	14.4	11.5	17.3	
70+	715	3.2	1.9	4.5		681	14.8	12.1	17.5	
Employment Status					0.12					< 0.01
Employers	1860	3.1	2.3	3.9		1841	16.9	15.2	18.6	
Employees	1555	4.1	3.1	5.1		1540	21.6	19.5	23.7	
Institution					0.04					< 0.01
Clinic	2151	3.0	2.3	3.7		2127	16.9	15.3	18.5	
Hospital	1128	4.7	3.5	5.9		1119	24.0	21.5	26.5	
Other	165	2.4	0.1	4.7		160	13.8	8.5	19.1	
Work Hours Per Day, h					0.06					< 0.01
< 6 h	388	3.9	2.0	5.8		379	12.7	9.3	16.1	
≥ 6 h but < 8 h	530	2.3	1.0	3.6		527	12.5	9.7	15.3	
≥ 8 h but < 10 h	1151	3.0	2.0	4.0		1150	17.4	15.2	19.6	
≥ 10 h but < 12 h	737	4.1	2.7	5.5		100	24.9	16.4	33.4	
≥ 12 h	434	5.5	3.4	7.6		732	26.9	23.7	30.1	
Number of Days of On-Call/Overnight Work					< 0.01					< 0.01
Never	2293	2.7	2.0	3.4		2265	16.2	14.7	17.7	
once every few months	205	3.4	0.9	5.9		205	19.0	13.6	24.4	
once every month	206	2.9	0.6	5.2		205	18.0	12.7	23.3	
2 to 3 times per month	259	6.9	3.8	10.0		259	28.6	23.1	34.1	
4 to 7 times per month	274	5.5	2.8	8.2		271	29.2	23.8	34.6	
≥ 8 times per month	177	7.3	3.5	11.1		176	26.1	19.6	32.6	
Number of Days Off Duty Per Month					0.01					< 0.01
Less than 4 days	583	5.7	3.8	7.6		581	23.6	20.1	27.1	
≥ 4 days but < 6 days	1304	3.3	2.3	4.3		1297	20.2	18.0	22.4	
≥ 6 days but < 8 days	100	2.3	0.0	5.2		469	19.4	15.8	23.0	
≥ 8 days but < 10 days	470	2.5	1.1	3.9		602	17.4	14.4	20.4	
≥ 10 days	602	5.0	3.3	6.7		339	10.9	7.6	14.2	
Sleep Duration, h					< 0.01					0.03
< 6 h	774	6.2	4.5	7.9		768	21.7	18.8	24.6	
≥ 6 h	2694	2.7	2.1	3.3		2657	18.3	16.8	19.8	
Lack of Rest Due to Sleep Deprivation					< 0.01					< 0.01
No	2320	2.0	1.4	2.6		2290	15.2	13.7	16.7	
Yes	1116	6.7	5.2	8.2		1103	26.8	24.2	29.4	
Insomnia					< 0.01					< 0.01
No	2789	3.0	2.4	3.6		2750	17.6	16.2	19.0	
Yes	697	5.6	3.9	7.3		685	24.8	21.6	28.0	

In each section, the missing data have been excluded from the statistical analyses. *Chi-square test; CI, confidence interval.

response rate was high, at approximately 80%. Therefore we consider that the participants were fairly representative of physicians throughout Japan, and that their responses accurately reflected those of physicians in general.

Work Status

According to the “Survey on Time Use and Leisure Activities” that was conducted by the Ministry of Internal Affairs and Communications in 2006, the mean work period per day for an

Table 6—Logistic regression results for prediction of excessive daytime sleepiness or experience of medical incidents

	Excessive Daytime Sleepiness				Experience of Medical Incidents			
	AOR	95% CI		p-value	AOR	95% CI		p-value
Sex								
Male	1.00				1.00			
Female	0.61	0.37	0.99	0.04	1.01	0.81	1.25	0.95
Age Group, y								
20-39	1.00				1.00			
40-49	0.76	0.40	1.43	0.40	1.11	0.81	1.53	0.51
50-59	0.77	0.40	1.49	0.44	1.04	0.75	1.45	0.81
60-69	0.61	0.27	1.40	0.24	0.71	0.48	1.06	0.09
70+	0.79	0.34	1.84	0.59	0.99	0.65	1.51	0.96
Employment Status								
Employers	1.00				1.00			
Employees	1.12	0.62	2.00	0.71	1.06	0.81	1.40	0.66
Institution								
Clinic	1.00				1.00			
Hospital	0.91	0.49	1.68	0.76	1.12	0.84	1.50	0.44
Other	1.00	0.33	3.09	0.99	1.04	0.60	1.80	0.90
Work Hours Per Day, h								
< 6 h	1.57	0.65	3.82	0.32	1.23	0.79	1.92	0.36
≥ 6 h but < 8 h	1.00				1.00			
≥ 8 h but < 10 h	1.16	0.56	2.39	0.69	1.31	0.95	1.81	0.10
≥ 10 h but < 12 h	0.93	0.42	2.07	0.85	1.72	1.21	2.45	< 0.01
≥ 12 h	0.88	0.37	2.10	0.77	1.72	1.15	2.58	0.01
Number of Days of On-Call/Overnight Work								
Never	1.00				1.00			
once every few months	1.54	0.68	3.50	0.31	1.09	0.74	1.62	0.66
once every month	1.22	0.50	2.96	0.66	0.99	0.66	1.47	0.95
2 to 3 times per month	2.49	1.29	4.81	0.01	1.54	1.09	2.16	0.01
4 to 7 times per month	1.68	0.83	3.39	0.15	1.49	1.06	2.08	0.02
≥ 8 times per month	2.16	1.05	4.43	0.04	1.26	0.84	1.87	0.26
Number of Days Off Duty Per Month								
< 4 days	1.23	0.73	2.06	0.43	0.86	0.66	1.12	0.25
≥ 4 days but < 6 days	1.00				1.00			
≥ 6 days but < 8 days	0.88	0.44	1.76	0.72	0.97	0.73	1.29	0.86
≥ 8 days but < 10 days	1.05	0.55	1.98	0.89	0.94	0.72	1.25	0.69
≥ 10 days	1.96	0.93	4.12	0.07	0.63	0.41	0.97	0.04
Sleep Duration, h								
< 6 h	1.60	1.04	2.47	0.03	0.83	0.65	1.05	0.12
≥ 6 h	1.00				1.00			
Lack of Rest Due to Sleep Deprivation								
No	1.00				1.00			
Yes	3.20	2.02	5.08	< 0.01	1.65	1.33	2.04	< 0.01
Insomnia								
No	1.00				1.00			
Yes	1.16	0.74	1.81	0.52	1.45	1.16	1.82	< 0.01

All the items included in this table were input as covariates in the logistic models. In each section, the missing data have been excluded from the statistical analyses. AOR, adjusted odds ratio; CI, confidence interval.

ordinary employed Japanese person is 420 minutes for men and 300 minutes for women.¹³ On the basis of the present results, which revealed daily work periods of 528.5 minutes for men and 479.6 minutes for women, it is clear that, in comparison with

Japanese persons in other occupations, both male and female physicians work notably longer hours. This study also indicated that the working hours of hospital-based physicians tended to be longer than those of clinic-based physicians. The “Report of

Physicians' Working Conditions Associated with Demand and Supply of Physicians" that was released in 2006 also indicated that physicians working in hospitals put in longer hours than those working in clinics.¹⁴ In this respect, the findings of the previous study were confirmed by the results of the present one. When the type of medical discipline was considered, surgeons had the longest working hours. This reflected data from previous studies of medical residents in the US and Japan.^{9,15} It is considered that work-related procedures—such as operations, post-surgical management, and the treatment of emergency patients—tend to increase the working hours of surgeons.

The results of this study revealed the actual situation for physicians in Japan: more than 40% of the surveyed obstetricians/gynecologists were on call/worked overnight four or more times per month, and more than 20% eight or more times per month. Obstetricians/gynecologists, who have to deal with emergency cases such as delivery and caesarean section at all hours, tend to be on call/work overnight more often. In comparison with conditions faced by physicians of other disciplines, the situations for obstetricians/gynecologists appear to be excessive. In recent years, along with the decline in the number of obstetricians/gynecologists, a decrease in the availability of obstetrical/gynecological services (as reflected in the declining number of maternity facilities) has become a social problem in Japan. As physicians can freely choose their areas of expertise and specialty, the declining number of physicians who opt to become obstetricians/gynecologists may be partly attributable to the outstandingly longer working hours required in comparison with other fields. Clearly, there is a need for effective measures to improve the working conditions of obstetricians/gynecologists in Japan.

As is the case for other occupations, *karoshi* (death due to overwork) and *karojisatsu* (suicide due to overwork) have also become social problems afflicting physicians in Japan.¹⁶ The findings of the present study concretize one aspect of this overwork situation affecting the Japanese medical profession. The legally stipulated working period in Japan is 40 hours per week. However, as physicians are required to take prompt remedial action in response to changes in their patients' conditions, they tend to put in more overtime hours than members of other professions. While the maximum working hours of a medical resident are set at 80 hours per week in the US,¹⁷ there is no similar limitation set for physicians in Japan. In order to protect the health and lives of physicians in Japan, we consider that the establishment of preventive measures against overwork is a pressing issue.

Sleep Status

This study also clarified the actual sleep status of Japanese physicians. The mean duration of sleep per day was found to be 6 h 26 min (386.0 min) for male physicians and 6 h 8 min (367.9 min) for female physicians. According to the "Survey on Time Use and Leisure Activities," the mean duration of sleep per day for an ordinary Japanese person is 6 h 47 min for men and 6 h 30 min for women.¹³ Although a stringent comparison with the "Survey on Time Use and Leisure Activities" is not possible because of differences in the timing and methodology employed, our data suggest that physicians tend to have fewer sleep hours at their disposal than people in other occupations. This study

has revealed that the sleep durations of Japanese physicians are inversely proportional to their working hours and the number of days of on-call/overnight work, and directly proportional to the number of days off duty. Although such an inverse relationship between the work and sleep hours of medical residents has already been reported,^{8,9} our present epidemiological findings provide confirmation through the use of samples representing the entire population of working physicians in Japan.

Lack of rest due to sleep deprivation—a factor that we adopted for the present analysis—is one of the health indices set by the Ministry of Health, Labour and Welfare of Japan. As part of the "Third National Health Promotion in the 21st Century (Healthy Japan 21)" program that introduced in 2000, the Ministry of Health, Labour and Welfare set a target of reducing the proportion of people reporting lack of rest due to sleep deprivation to less than 21% of the Japanese population.¹⁸ According to the "National Health and Nutrition Survey" of the general population of Japan conducted by the Ministry of Health, Labour and Welfare in 2007, the prevalence of lack of rest due to sleep deprivation was 21.9% for men and 23.5% for women.¹⁹ With the intention of comparing the results of the present study with those of the National Health and Nutrition Survey, we used the same question and response options for lack of rest due to sleep deprivation. The results showed that the prevalence of insufficient rest due to sleep deprivation was 30.4% for male physicians and 36.6% for female physicians, both being higher than the figures for the general population. This study is the first to have demonstrated that lack of rest due to sleep deprivation among physicians has a proportional relationship with working hours and the number of days of on-call/overnight work, and an inverse relationship with the number of days off duty.

Insomnia, whose major symptoms include difficulty initiating sleep, difficulty maintaining sleep, and early morning awakening, is one of the most frequently observed sleep disorders in developed countries.²⁰ Concurrently with this study, we also conducted a nationwide survey of 2,614 ordinary Japanese people and reported on the prevalence of insomnia.²¹ For this purpose, we used the same definition of insomnia as that in the survey of the general population, to allow direct comparison of its prevalence with that in physicians. As a result, whereas the prevalence of insomnia among the general population was found to be 12.2% (95% confidence interval [CI]: 10.3% to 14.1%) for men and 14.6% (95% CI: 12.8% to 16.4%) for women, its prevalence among physicians was 21.0% (95% CI: 19.3% to 22.7%) for male physicians and 18.1% (95% CI: 15.9% to 20.3%) for female physicians. Thus, as far as the male population is concerned, was clarified that the prevalence of insomnia is significantly higher among physicians than among the general population. Insomnia sometimes occurs as a primary disorder and sometimes as a secondary disorder associated with other diseases.²⁰ Insomnia is also known to be a risk factor for mental and physical disorders,²²⁻²⁵ and to increase the risk of mortality.²⁶ Therefore, development of countermeasures against insomnia in physicians is essential for both the management and promotion of health in physicians.

It has been pointed out in a previous report that the sleep problems of physicians are characterized by five features: (1) short sleep duration, (2) continuous sleep deprivation over an extended period, (3) a high risk of acute sleep deprivation

due to overnight work, etc., (4) irregular bedtimes and waking times, and (5) segmented nighttime sleep.²⁷ On the basis of these characteristics, it is necessary to develop public health measures to address the sleep problems of physicians under an initiative by the JMA as well as the Ministry of Health, Labour and Welfare.

Excessive Daytime Sleepiness

Excessive daytime sleepiness is a symptom induced by nighttime sleep disorder,²⁸ which should be distinguished from the physiological sleepiness felt by the majority of ordinary people. As excessive daytime sleepiness can cause traffic or industrial accidents, it is identified as an important public health issue.^{4,29} Therefore, studies of excessive daytime sleepiness have been widely conducted in recent years, leading to a wide accumulation of various epidemiological findings.³⁰⁻³² A previous survey conducted among the general population in Japan reported that short sleep duration, subjective sleep insufficiency, and lack of rest due to sleep deprivation are factors that are significantly related to excessive daytime sleepiness.^{33,34}

It is easily understandable that, in the case of physicians, excessive daytime sleepiness can cause medical errors—a possibility that is significant in terms of medical safety. The present study revealed that, as is the case for the general population, excessive daytime sleepiness in physicians is also associated with short sleep duration and lack of rest due to sleep deprivation. In addition, our statistical analysis clarified that the adjusted odds ratio for excessive daytime sleepiness in physicians increased significantly as the number of days of on-call/overnight work increased. From the above findings, we consider it necessary to prevent excessive daytime sleepiness in physicians by ensuring that they have an opportunity to take proper rest through adequate sleep duration and by paying attention to the number of days they work on call/overnight.

Experience of Medical Incidents

In addition to the issue of excessive daytime sleepiness, this study also addressed medical incidents that had actually occurred in the previous one month, with the aim of securing medical safety. We found that long work hours, frequent on-call/overnight work, lack of rest due to sleep deprivation, and insomnia were each independently associated with medical incidents that physicians had experienced in the previous month. A survey conducted among 1,366 young physicians in New Zealand also revealed that the adjusted odds ratio for clinical errors increased when the number of days of on-call/overnight work exceeded three times within two weeks.³⁵ Our present result is consistent with this.

Interestingly, although the odds ratio for the experience of medical incidents was significantly high among those who were on-call/worked overnight 2-7 times per month, a significant increase in the odds ratio was not observed among those who were on-call/worked overnight eight or more times per month. Thus, the association was not a simple proportional relationship, in which the odds ratio for the experience of medical incidents increased as the number of days of on-call/overnight work increased. Physicians who occasionally worked overnight may not have been able to adjust to changes in sleep schedule/circadian rhythms, which may have caused a significantly

high number of medical incidents. On the other hand, physicians who regularly worked overnight could adjust well to the changes in the sleep schedule/circadian rhythms. The results of this study also indicated that the experience of medical incidents was closely associated with insomnia, although it was not associated with sleep duration. Thus, our study suggests that the experience of medical incidents was more strongly affected by the quality of sleep and the disturbance in the circadian rhythms than by the duration of sleep.

As this study was based on a cross-sectional survey, we were unable to assess the causality between medical incidents and their correlated factors. For some physicians among our selected sample, we presume that lack of rest due to sleep deprivation or insomnia had induced medical incidents; however, we did not consider the possibility that some of these physicians could have had trouble sleeping due to their worry about having experienced a medical incident. Our future task will be to study these causalities in a longitudinal survey.

Limitations

This study had a few limitations. First, as was mentioned above, the study was based on a cross-sectional survey, and therefore this limits any consideration of causality. Second, as the data were collected through a self-administered questionnaire, there is a possibility that the respondents tended to underestimate any unfavorable information, even though it was provided on an anonymous basis. In addition, many subjective terms were used in the response options of the survey questions. Third, as the survey was based on the retrospective responses of the respondents, we cannot exclude the possibility that some recall bias may have been included. Fourth, the questionnaire did not have any question regarding napping, daytime sleep, shift pattern, and medical errors that actually affected the patient adversely. Fifth, some response bias may have existed because approximately 20% of the subjects did not participate in our study. However, there were no significant differences between the prevalence of excessive daytime sleepiness and the experience of medical incidents among the subjects who sent their responses at different times. Therefore, the distributions of the responses of excessive daytime sleepiness and experience of medical incidents were not largely different between those who responded immediately and those who responded late. Therefore, if any response bias had existed, it may not have substantially distorted the results of this study.

CONCLUSIONS

With regard to the work situations of physicians in Japan, this study has clarified that surgeons work exceedingly long hours and that obstetricians/gynecologists face a high frequency of on-call/overnight work. With regard to the sleep status of physicians in Japan, it has become clear that they have more trouble sleeping than the general population. This study also indicates that the excessive daytime sleepiness and medical incidents encountered by Japanese physicians are closely associated with both their work situation and their sleep status. To provide adequate health management for physicians and to improve medical safety, we consider it important that adequate attention be paid to physicians' work and sleep.

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DISCLOSURE STATEMENT

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