ORIGINAL ARTICLE
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Depressive symptoms and overwork among physicians employed at a university hospital in Japan

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Abstract

Introduction: The excessive workload of Japanese hospital physicians is a serious social problem due to effects on their mental health status, as well as the potential for medical errors and lawsuits. The extent of overwork among resident physicians employed at national university hospitals in Japan is unknown and needs to be investigated.

Methods: This study used a questionnaire recommended by the Japanese Ministry of Health for hospital physicians working overtime, administered through an interview carried out by an occupational physician during the health surveillance to evaluate: 1) the severity of chronic fatigue; 2) the burden of work; 3) an overwork score derived from these two measures; and 4) presence of depressive symptoms. After the feasibility of the questionnaire was confirmed, both a cross-sectional and a longitudinal study were performed, while statistics analysis included multiple linear regression analysis and chi-square test set at $P < 0.05$.

Results: Most of the overworked physicians were young medical staffs (48%), whereas postgraduate residents formed a small group (10%). In the cross-sectional study (n = 135; mean age 32.7 years ± 5.6), the histograms of scores for the four factors investigated showed a strong positive skewness, while overtime histograms showed a negative skewness at 4, 3, and 2 months prior to the interview with occupational physician, but positive skewness 1 month prior to the interview. The longitudinal study (n = 26) showed an increase or reduction of overtime respectively having a significant impact on exacerbation or improvement of the overwork score ($P = 0.028$) and depressive symptoms ($P = 0.025$).

Discussion and Conclusions: A strong positive skewness of the histograms for items related to overwork might indicate fear of stigma of mental illness amongst young physicians. Physicians employed at Japanese national university hospitals should be protected by the institution, and the roles of occupational physician and health surveillance are crucial and should be effectively implemented.

KEY WORDS: Legislation, hospital; Japan; physicians; preventive psychiatry; psychology, industrial; social stigma; occupational health physicians; overtime work.

Riassunto

Introduzione: L'eccessivo carico di lavoro tra i medici ospedalieri giapponesi è un serio problema sociale per gli effetti sulla loro salute mentale, cosi come per il potenziale di errori medici e di cause legali. Il grado di sovraccarico lavorativo tra i medici che lavorano presso gli ospedali universitari nazionali in Giappone è sconosciuto e necessita di essere indagato.
Metodi: In questo studio è stato utilizzato un questionario raccomandato dal Ministero Giapponese della Salute per i medici ospedalieri che svolgono lavoro straordinario, somministrato nel corso di un intervista effettuata da parte di un medico del lavoro durante la sorveglianza sanitaria per valutare: 1) l'intensità della fatica cronica; 2) il carico di lavoro; 3) il punteggio relativo al sovraccarico di lavoro ottenuto da queste due misure; e 4) la presenza di sintomi depressivi. Dopo che l'utilizzabilità del questionario è stata confermata, sono stati realizzati uno studio trasversale ed uno longitudinale e l'analisi statistica ha incluso l'analisi di regressione multipla ed il test del chi quadrato, con una significatività statistica pari a $P < 0.05$.
Risultati: La maggior parte dei medici sovraccarichi era composta da medici ospedalieri di giovane età (48%), mentre i medici specializzandi rappresentavano solo un piccolo gruppo (10%). Nello studio trasversale (n = 135; età media 32,7 anni ± 5.6), gli istogrammi dei punteggi per i quattro fattori indagati hanno mostrato una forte asimmetria positiva, mentre quelli per il lavoro straordinario hanno evidenziato una'asimmetria negativa 4, 3 e 2 mesi prima dell'intervista con il medico del lavoro, al contrario un'asimmetria positiva 1 mese prima dell'intervista. Lo studio longitudinale (n = 26) ha evidenziato un significativo impatto che l'incremento o la riduzione del lavoro straordinario hanno avuto rispettivamente sull'aumento o sulla diminuzione del punteggio relativo al sovraccarico di lavoro ($P = 0.028$) e su quello relativo alla presenza di sintomi depressivi ($P = 0.025$).
Discussione e Conclusioni: Una forte asimmetria positiva degli istogrammi per gli items correlati al sovraccarico di lavoro potrebbe indicare il timore dei giovani medici per lo stigma sociale causato dalla malattia mentale. I medici che lavorano negli ospedali universitari nazionali giapponesi dovrebbero essere protetti dalle istituzioni ed il ruolo dei medici del lavoro e della sorveglianza sanitaria è cruciale e dovrebbe essere efficacemente implementato.

TAKE-HOME MESSAGE

In Japanase university hospital physicians, there is an association between overwork and depressive symptoms. The questionnaire set up by the Japanase Ministry of Health was successfully used as a screening tool in this health surveillance programme by occupational physicians and was useful to study the association between depressive symptoms, severity of chronic fatigue and burden of work.

Competing interests - none declared.

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INTRODUCTION

There is growing evidence of the importance of mental health among physicians to prevent the potential risks mental health disorders impose on medical practice [1–4]. Burnout syndrome is a serious problem in overworked physicians. Reportedly, more than half of the US physicians are now experiencing professional burnout, and satisfaction with work-life balance is worsening [1], indicating that physician burnout has reached epidemic levels [2]. Burnout profoundly impairs physicians' working effectiveness, quality of own care as well as patient care, and activity of entire healthcare system [3]. Moreover, there are many studies linking depression and depressive symptoms with medical job. Such studies have been limited to specific populations of physicians such as residents [5], those with fewer length of service [6], physicians in particular medical specialties [7] and general practitioners [8]. Further, a recent systematic review showed a high prevalence of depression among resident physicians resulting in poor-quality patient care and increased medical errors [9]. In addition, it has been showed a direct association between workload and depression among physicians: for instance, at the average of 50-70h/week most physicians work might be associated with a higher prevalence of depression [10].

In Japan, it has been suggested that the recent phenomenon of suicide and *Karoshi* (death from overwork) among regular workers might not be mainly from financial problems during the recent economic crisis affecting Japan, but from deteriorated work environments and heavy workloads [11]. Work-related consequences include job dissatisfaction, poorer quality of care, professional mistakes, absenteeism, intention to give up the profession, and abandonment [12]. Furthermore, such mental health disorders affect physicians' postgraduate education [13] and family happiness [14], and they are not generally limited to the intensive care field [15, 16]. Current occupational mental health status of physicians employed at Japanese university hospitals remains unknown, because the social environment of the medical field is dramatically changing in Japan. Indeed, in 2004, a 2-year clinical residency training system became immediately mandatory after graduation for postgraduate fellows in Japan, and the training program was substantially revised by the Japanese Ministry of Health, Labor and Welfare [17] to cover all major medical departments. As a result, postgraduate fellows (known as 'residents') have to rotate through many hospital departments in different clinical fields. Each resident usually stays in a certain department for 1 to 2 months, and hence they have to rapidly develop good relationships with the ward staff in each department and must adapt to different ward systems. Moreover, status as a legal entity was provided to all of the Japanese national universities by the Ministry of Education, Culture, Sports, Science and Technology under the National University Corporation Act [18]. This allows various actions by the national universities, including ventures or joint businesses founded with private companies. Advisors may propose revolutionary action plans to the university President for management changes to improve the university's reputation in the global rankings. However, most staffs working in the university hospitals, including physicians, are busier than before, being burdened with additional tasks and evaluated strictly by the university administration in relation to effort and outcomes. In such a scenario, this study was aimed to survey the situation concerning overworking among hospital physicians and, specifically, to clarify the relationship between the severity of chronic fatigue, the burden of work, depressive symptoms, and the amount of overtime worked by physicians employed at a national university hospital in Fukuoka, Japan.

METHODS

Subjects

The study population consisted of 135 Japanese physicians working overtime at a Japanese national university hospital in Fukuoka. During the study period (April 2014 - March

2017) 690 physicians (approximately 25 full professors, 50 associate professors, 77 assistant professors, 83 tutors, 205 medical staffs, and 250 residents) resulted to be annually employed at this university hospital. According to the Japanese labor law, 100 hours of overtime per month or overtime exceeding 80 hours per month for 3 consecutive months require that each worker must be subjected to health surveillance carried out by an occupational physician, who has to use a specific questionnaire administered with a semi-structured interview based on a checklist recommended by the Japanese Ministry of Health, Labor and Welfare [19]. In this study, physicians who were meeting these criteria were automatically listed by the General Affairs Section of this university hospital and recruited by occupational nurses.

Ethical clearance

All procedures performed in this study were in accordance with the ethical standards of our institutional research committee, i.e., the study design was approved by the Internal Ethics Committee of this University (201401). Interviews with the physicians were required by the labor law and were conducted according to the updated Declaration of Helsinki (2008). Although the questionnaire completion and interview were legally required, the physicians could decide whether to allow their data to be used in this study by providing written informed consent. Interviews with overworked physicians employed at this university hospital were arranged by occupational nurses and carried out by an occupational physician in a quiet room located in the infirmary of the General Affairs Section of the university. Personal privacy was strictly protected.

Study Instruments

We used two instruments recommended by the Japanese Ministry of Health, Labor and Welfare [19], which were a checklist-based interview and a questionnaire (Table 1) composed of three sub-scales to estimate the presence and severity of mental health symptoms related to chronic fatigue (13 items) and depressive status (5 items), and to evaluate the burden of work (7 items). Subjects responded to each item by answering 'rarely', 'sometimes' or 'often'. Based on the severity of chronic fatigue and the burden of work, an 'overwork score' was determined by a specified chart (Table 2) [19]. In this study, we measured only generic symptoms of chronic fatigue status including mental and physical fatigue and not the symptoms of the 'chronic fatigue syndrome' that is a clinical entity affecting mental, physical, neuroendocrine and immune system and overlapping sometimes fibromyalgia [20–22]. The 5-item scale of the questionnaire used to evaluate depressive symptoms was performed by the subjects, with each item receiving a 'yes' or 'no' answer. Diagnosis of major depressive disorder in primary care should be based on DSM 5 criteria or ICD-10 diagnostic criteria, so this questionnaire was only used for evaluating depressive symptoms but not for diagnosing depression *per se*.

The Feasibility Study

Although this study used instruments recommended by the Ministry of Health, Labor and Welfare, application of this questionnaire has not yet been validated by research. Therefore, Cronbach's α coefficient was calculated to assess the internal integrity and persistency of this questionnaire as applied to hospital physicians, a highly specialized occupational population exposed to work-related stress strain. The feasibility of this questionnaire was tested by investigating the relationship between the overwork score and the severity of chronic fatigue or the burden of work. Multiple linear regression analyses were performed with independent variables including the severity of chronic fatigue and the burden of work, and the overwork score as dependent or 'outcome' variable.

Study design

Cross-sectional study

The cross-sectional study included 135 Ja-

Table 1. Questionnaire for overworked physicians recommended by the Japanese Ministry of Health.

Severity of chronic fatigue		rarely (0)	sometimes (1)	often (3)
1.	I get annoyed.			
2.	I am anxious.			
3.	I do not feel at ease.			
4.	I am gloomy.			
5.	I cannot sleep well.			
6.	I am in poor condition.			
7.	I cannot concentrate.			
8.	I make many mistakes.			
9.	I feel very sleepy while at work.			
10.	I have no motivation.			
11.	I am tired out.			
12.	I feel fatigued even when I get up in the morning.			
13.	I become tired more easily in comparison with the past.			

Burden of work		rarely (0)	sometimes (1)	often (3)
1.	Overtime in a month			
2.	Irregular duties			
3.	Burden of business travel			
4.	Burden of nightshifts			
5.	Breaks and naps			
6.	Mental burden of work			
7.	Physical burden of work			

Depressive symptoms		yes (1)	no (0)
1.	I do not have a sense of fulfillment in daily life.		
2.	I cannot enjoy what I used to enjoy.		
3.	Things that I could do easily before have become troublesome.		
4.	I do not consider myself as a valuable human being.		
5.	I always feel tired with no specific reason.		

Note: Parentheses indicate score in each item.

Table 2. Chart of 'overwork' score based on the 'severity of chronic fatigue' and the 'burden of work'.

Total Score in Burden of Work					
		0	1 - 2	3 - 5	6 or more
Total Score in Severity of Chronic Fatigue	0-4	0	0	2	4
	5-10	0	1	3	5
	11-20	0	2	4	6
	more than 20	1	3	5	7

Note: Overwork score is determined by total scores in burden of work and severity of chronic fatigue.

panese practitioners working overtime at the university hospital. When they visited the infirmary, they were administered the questionnaire with a checklist-based semi-structured interview by an occupational physician according to the Japanese labor law.

Longitudinal study

Among the 135 physicians recruited for the cross-sectional study, 26 of them were also followed in a longitudinal study. This small group of physicians continued to work overtime after the initial interview and, therefore, they were a high-risk group. An annual administered questionnaire was arranged by occupational nurses, and was followed by an interview with an occupational physician. The relationship between overtime and above-mentioned parameters was investigated longitudinally, i.e., the relationship between changes in the amount of overtime *versus* the overwork score and that between changes in the amount of overtime *versus* depressive symptoms. 'More overtime' was defined as the amount of overtime increased, and 'less overtime' was defined as the amount of overtime decreased within the study period (n = 26).

Statistical analysis

Data were expressed as mean ± SD for continuous variables. The Kolmogorov-Smirnov test was used to investigate the normality of data distribution. None of the variables with missing data was qualified for this research. Multiple linear regression analysis was performed to identify significant contributors to the objective variable among several explanatory variables in the feasibility study and the cross-sectional study, while the chi-square (χ^2) test or Fisher's exact test was employed in the longitudinal study. Yates' correction was added if necessary. Analyses were performed by using PASW software (Windows version 18.0; SPSS, Chicago, Ill, USA). Statistical significance was set up at $P < 0.05$.

RESULTS

Subjects and Questionnaire

The subjects enrolled in this study included 135 physicians (M = 120, F = 15), with a mean age of 32.7 years ± 5.6. Most of the doctors were in their 30s (n = 76), followed by those in their 20s (n = 42) and those in their 40s (n = 16). A breakdown of their positions (A) and types of specialization (B) is shown in Figure 1A-B.

In the medical department of a Japanese university hospital, the hierarchical order is as follows: professor, associate professor, assistant professor, tutor (or hospital assistant), medical staff, and resident. As detailed in Figure 1A, medical staff accounted for approximately half of all overworked doctors (48%). Tutors and assistant professors occupied about 18% and 14%, respectively, while residents formed about 10% of the overworked doctors. Percentage of overworking doctors in each job title was about 12% in professors, 20% in associate professors, 25% in assistant professors, 29% in tutors, 32% in medical staffs, and 6% in residents. Figure 1B shows the clinical departments of the overworked doctors. Specialist surgery included cardiac surgery, neurosurgery, and pediatric surgery, while general surgery included thoracic and gastrointestinal surgery. Specialist clinical departments included ophthalmology and otolaryngology. The emergency department included the intensive care unit (ICU) and anesthesiology. Internal medicine included general medicine and pediatrics. Miscellaneous sections included laboratory medicine and radiology diagnostics.

Figure 1A.

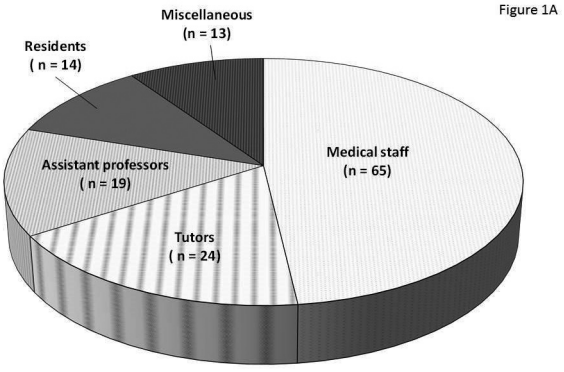


Figure 1B.

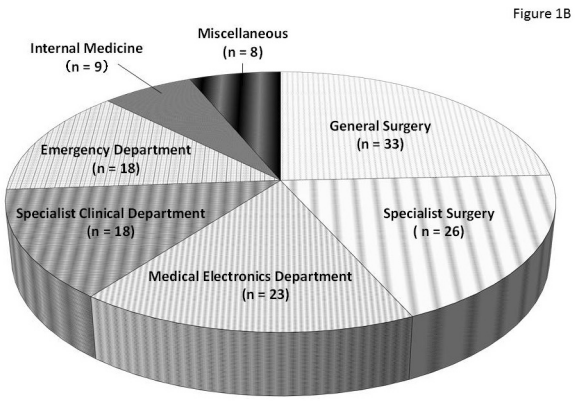
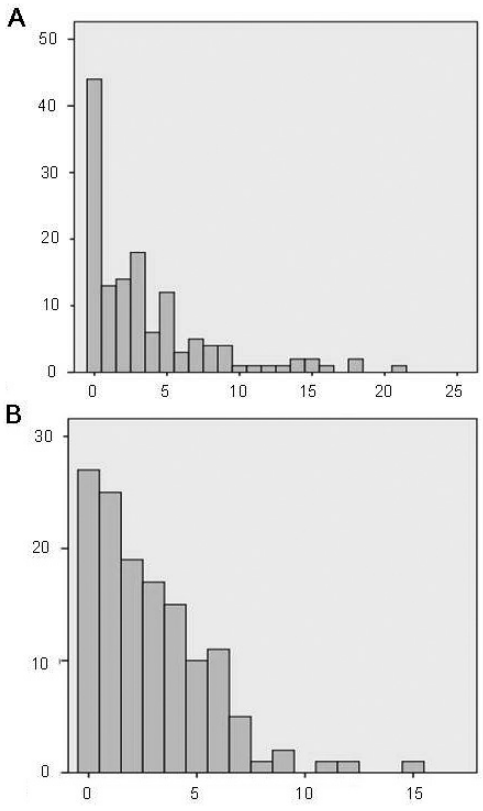


Figure 1A-B. The positions (A) and affiliations (B) of the doctors interviewed for this study (*n* =135).

The histograms of the severity of chronic fatigue (A), the burden of work (B), the overwork score derived from these two variables (C), and depressive symptoms (D) in the 135 doctors are displayed in Figure 2. The data did not show a normal distribution, and a strong positive skewness was noted in all cases (+ 1.77 in A, + 1.39 in B, + 0.95 in C, and + 2.53 in D). Because the findings were based on data from questionnaires, the feasibility of the questionnaire used required validation.



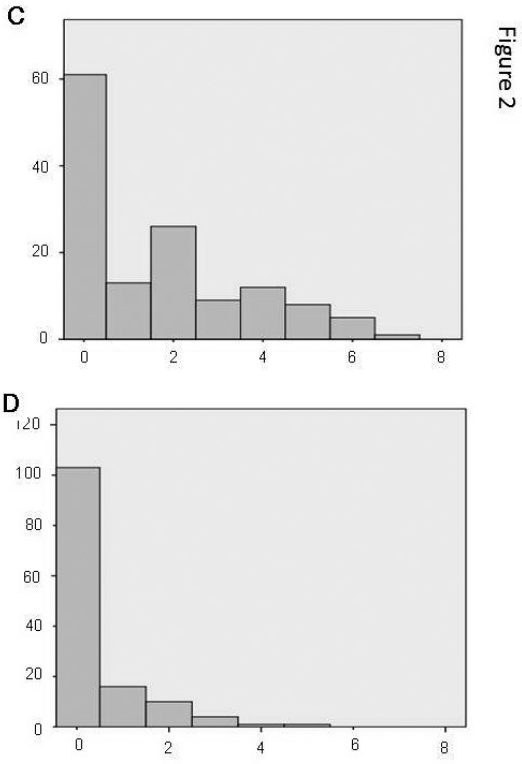


Figure 2. Histograms for the severity of chronic fatigue (A), the burden of work (B), the overwork score derived from these two factors (C), and depressive symptoms (D) based on data from administered questionnaires.

The Feasibility Study

Cronbach's α coefficient was 0.77 for the severity of chronic fatigue, 0.65 for the burden of work, 0.65 for the overwork score, and 0.80 for depressive symptoms (*n* = 135). A multiple regression model was created by setting the overwork score as the 'dependent' variable and the amount of overtime, age, gender, severity of chronic fatigue, burden of work, and depressive symptoms as 'independent' variables. As shown in the Table 3, this analysis revealed that the severity of chronic fatigue (standardized partial regression coefficient (β) = 0.24, P < 0.001) and the burden of work (standardized β = 0.76, P < 0.001) were significant contributors, with the coefficient of determination (R^2) being 0.85, indicating that the overwork score purely reflects the severity of chronic fatigue and the burden of work.

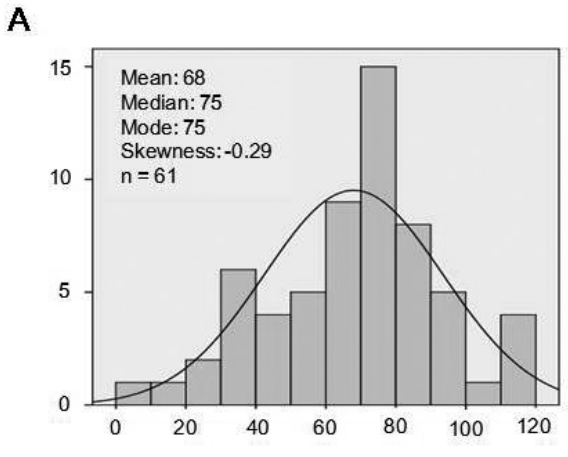
Table 3. Multiple linear regression analyses for association of self-administered questionnaires.

	β	Standardized β	95% CI of β	P value
1) Overwork score (R^2 = 0.852)				
Burden of work	0.526	0.762	0.468 – 0.583	< 0.001
Severity of chronic fatigue	0.099	0.236	0.064 – 0.134	< 0.001
2) Severity of chronic fatigue (R^2 = 0.610)				
Depressive symptoms	2.355	0.482	1.771 – 2.940	< 0.001
Burden of work	0.691	0.421	0.494 – 0.888	< 0.001
Overworking time per month	-0.022	-0.109	0.045 – 0.001	0.062
Age	0.064	0.082	- 0.031 – 0.158	0.183
Gender	0.965	0.069	0.583 – 2.513	0.220
3) Burden of work (R^2 = 0.396)				
Severity of chronic fatigue	0.398	0.653	0.285 – 0.512	< 0.001
Overworking time per month	0.020	0.165	0.003 – 0.038	0.022
Gender	- 0.637	- 0.075	- 1.814 – 0.539	- 1.814 – 0.539
Age	0.017	0.036	- 0.055 – 0.089	0.636
4) Depressive symptoms (R^2 = 0.441)				
Severity of chronic fatigue	0.142	0.692	0.107 – 0.177	< 0.001
Gender	- 0.263	- 0.092	- 0.642 – 0.117	0.173
Overworking time per month	0.003	0.080	- 0.002 – 0.009	0.253
Burden of work	- 0.027	- 0.081	- 0.084 – 0.029	0.343

Note: β, partial regression coefficient; CI, confidence of interval; R^2, coefficient of determination (n = 135).

Cross-sectional study

Criteria for completing the questionnaire and interview were 100 hours of overtime per month or overtime exceeding 80 hours per month for 3 consecutive months. Therefore, the distribution of overtime worked by physicians who completed the questionnaire is demonstrated for each month prior to the interview in Figure 3, i.e., overtime worked 4 months (A), 3 months (B), 2 months (C) and 1 month (D) before the interview. As the date of the interview approached, numbers of physicians included in the histograms increased gradually (n = 61 in A, n = 87 in B, n = 116 in C, n = 135 in D), and mean overtime increased from 65 ± 25 (range: 14 to 119) hours in A to 101 ± 22 (range: 66 to 211) hours in D. The histograms did not show a normal distribution, with negative skewness increasing from A (-0.29) to C (-1.42), whereas D showed positive skewness (+1.77). This indicates that the physicians made efforts to keep their overtime below 80 hours per month (the mode in A, B and C was 71 to 77 hours per month), but they did not pay attention to self-regulation when overtime clearly was exceeding 80 hours (the mode in D was 87 hours per month). Normal distribution curves derived from actual data were added.



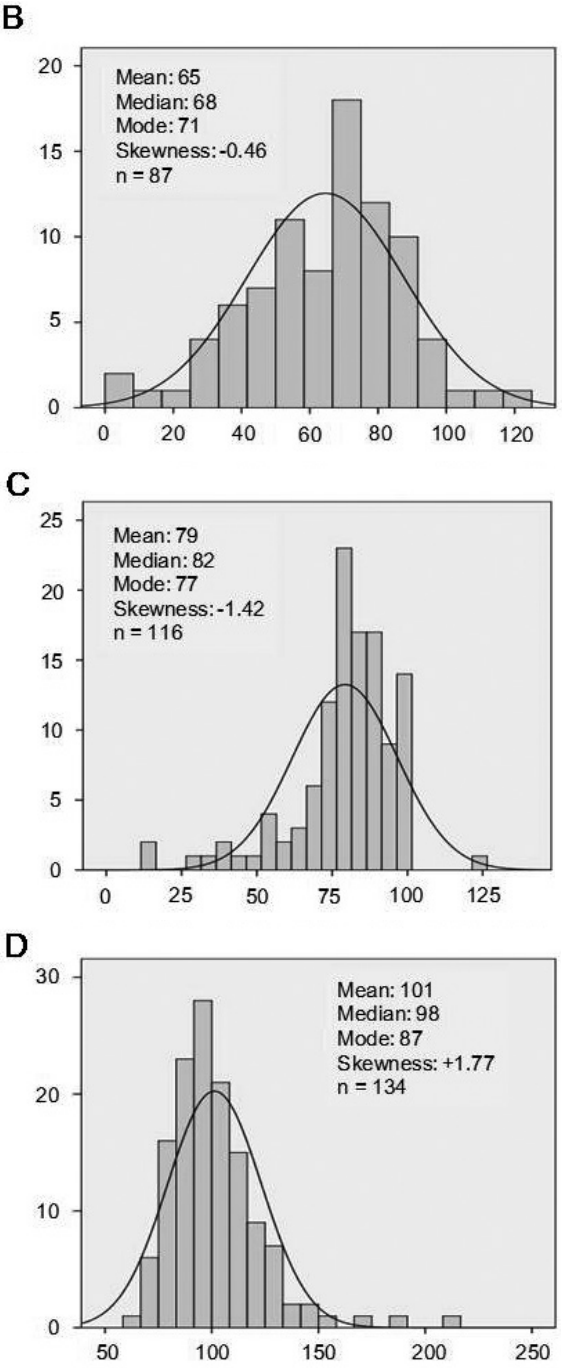


Figure 3A-D. Distribution of overtime at 4 months (A), 3 months (B), 2 months (C) and 1 month (D) prior to interview by an occupational physician.

As showed in Table 3, a multiple linear regression analysis was performed to identify independent contributors to the severity of chronic fatigue, the burden of work, and depressive symptoms. Significant contributors to the severity of chronic fatigue were the depressive symptoms (standardized $\beta = 0.48$, $P < 0.001$) and the burden of work (standardized $\beta = 0.42$, $P < 0.001$), with R^2 being 0.61. Significant contributors to the burden of work were the severity of chronic fatigue (standardized $\beta = 0.65$, $P < 0.001$) and the amount of overworking time prior to the interview (standardized $\beta = 0.17$, $P = 0.022$), with R^2 being 0.40. This analysis also revealed that only the overwork score (based on the severity of chronic fatigue and the burden of work) contributed significantly to depressive symptoms (standardized $\beta = 0.40$, $P < 0.001$, $R^2 = 0.21$, not shown). In more detail, only the severity of chronic fatigue was a significant contributor to the depressive symptoms (standardized $\beta = 0.69$, $P < 0.001$, $R^2 = 0.44$).

Longitudinal study

Among the 135 Japanese physicians in the cross-sectional study, only 26 were included in the longitudinal study and interviewed by an occupational physician annually for 2 to 6 years (2.72 ± 1.06 years). These physicians worked overtime repetitively after the initial interview and, therefore, they were listed as a high-risk group. Cross tables were constructed for the relationship between changes in the amount of overtime *versus* the overwork score and between changes in the amount of overtime *versus* depressive symptoms (Table 4). If overtime increased ('more overtime') or decreased ('less overtime') within the study period, there was a significant impact on the changes of the overwork score ($\chi^2 = 4.82$, $P = 0.028$) and depressive symptoms ($\chi^2 = 5.05$, $P = 0.025$).

Table 4. Effect of an increase or decrease of overtime on the overwork score and depressive symptoms.

1) Effect of overtime on the overwork score		
	More overtime	Less overtime
Overwork score increased	8	6
Overwork score decreased	1	11

(df = 1, n = 26, χ^2 = 4.82, P = 0.028)

2) Effect of overtime on depressive symptoms		
	More overtime	Less overtime
Depressive symptoms worse	7	4
Depressive symptoms improved	2	13

(df = 1, n = 26, χ^2 = 5.05, P = 0.025)

DISCUSSION

The present study surveyed chronic fatigue, the burden of work, depressive symptoms, and monthly overtime hours investigating the relationships among these factors in physicians employed at a Japanese national university hospital after that the feasibility of the questionnaire used to obtain data was confirmed.

Summary of key findings

The main findings of the present study were as follows: 1) about half of the overworked physicians were relatively young medical staff; 2) histograms for the severity of chronic fatigue, the burden of work, the overwork score derived from the previous two factors, and depressive symptoms all showed a strong positive skewness; 3) the overtime histogram showed a negative skewness at 4, 3, and 2 months prior to interview by an occupational physician, but a positive skewness 1 month prior to the interview (cross-sectional study, *n* = 135); and 4) an increase or decrease of overtime had a significant impact on exacerbation or improvement of the overwork score and depressive symptoms (longitudinal study, *n* = 26).

Current status of physicians

Currently, electronic medical records are used in the majority of Japanese hospitals and electronic systems promote both efficiency and accuracy of hospital management. However, the burden on physicians is increased at every step of electronic input concerning patient care including admission planning; prescription of medications; ordering medical, laboratory, or radiology tests; providing orders for surgery, transfusion, rehabilitation, and nutritional supplementation; and discharge planning [4]. Suzuki reported that Japanese physicians working in general hospitals are exhausted and have poor mental health [23]. Moreover, rapid hospitalization of patients to increase the bed 'turnover rate' and to reduce empty beds is required, because national university hospitals have to make a profit after obtaining status as legal entities [18]. In such circumstances, this study demonstrated that residents are protected by the new 2-year postgraduate clinical training system that became mandatory in 2004 [17], because the percentage of overworking residents was only 6%. Conversely, young medical staff and tutors showed the highest percentage of overworking (32% and 29%, respectively) among all the job positions, probably because they have to combine the three major tasks of clinical duties, research, and education (Figure 1A). Many medical staffs are employed by this university hospital on a short-term basis for one or several years, and hence they can survive this relatively short period filled with many duties.

It can be difficult to reduce overtime in some departments (see Figure 1B) due to long-lasting or emergent surgery or staff shortages. However, it seems that physicians generally make efforts to reduce their overtime. In the

cross-sectional study, negative skewness of the distribution of overtime a few months prior to the interview supports this speculation (Figure 3A-C). However, the positive skewness of the distribution of overtime at 1 month before the interview (Figure 3D) indicates that overtime worked by these physicians was different from the average overtime of about 80 hours in the other months, i.e., physicians working more than 100 hours of overtime per month may have no motive to limit their overwork to 80 hours per month.

Implication for future research

In spite of current status of overwork among Japanese hospital physicians, work-life balance and individual well-being are important to improve their mental and physical health and to prevent medical errors and lawsuits [2, 3, 24]. The present study indicates that reducing overtime leads to improvement of the overwork score and depressive symptoms (Table 4). These findings may promote and establish a strategy to prevent burnout, depression and death from overwork as a matter of national policy. Actually, Japanese Government passed the Act on promotion of preventive measures against *Karoshi* and other overwork-related health disorders in 2014. However, physicians have to respond to the emergency call from their hospital by the medical practitioners' law. Therefore, it is not clear whether physicians may benefit from this Act [25].

Strenghs and Limitations

The findings of the present study should be interpreted with caution due to some limitations. The first limitation is related to evaluation of depression. This study was based on data gathered from the questionnaire used to assess long working hours and the mental health status of Japanese hospital physicians. The Japanese Ministry of Education, Culture, Sports, Science and Technology recommended using this five-item questionnaire for evaluation of depressive symptoms and overworking [19]. However, this study evaluated only depressive symptoms, but not depression *per se*, which is the most prevalent mental health problem in the working-age population. Likewise, this study estimated symptoms of chronic fatigue status but neither 'Chronic fatigue syndrome' or 'Burnout syndrome' [20–22]. However, there is some evidence that Burnout syndrome could share some characteristics with depression [26] and chronic fatigue syndrome [27–29], and in this study depressive symptoms were found to be linked to severity of the chronic fatigue status.
The second limitation was the small number of physicians included in the longitudinal study, due to the characteristics of the Japanese university hospitals. Indeed, young physicians need to acquire clinical experience at university hospitals to become qualified as specialists. Therefore, many of them usually work there for only one or a few years, preventing long follow-up studies.
The third limitation was related to the validity of the used questionnaire. Although a feasibility study was performed, this questionnaire has not yet validated in past scientific surveys. Moreover, overtime should cover all hours worked outside the authorized working hours, including management of outpatients who visit at night, emergency treatment of hospitalized patients at night, writing scientific papers, and basic laboratory research work. However, some physicians stated that their listed overtime was limited to ward duties at night. Therefore, answers to the questionnaire could be biased. Finally, physicians usually wish to avoid being diagnosed with depression, because stigma associated with a diagnosis of mental illness may have a potential long-term adverse influence on career development [30, 31]. In this study, histograms for the severity of chronic fatigue, the burden of work, and depressive symptoms showed a strong positive skewness (Figure 2). This might mean fear of stigmatization among overworked physicians at this national university hospital.
On the contrary, the strength of this study was that the specific questionnaire set up by the Japanase Ministry of Health was successfully used for the first time, and it could be a

good instrument to evaluate depressive symptoms and overwork in future research.

CONCLUSIONS

After the introduction of mandatory clinical training for residents and the corporatization of the Japanese national universities in 2004, the problem of overworking among university hospital physicians has become serious. In this study, we found that histograms for the severity of chronic fatigue, the burden of work, and depressive symptoms showed a strong positive skewness, implying fear of stigmatization among physicians employed at this national university hospital. In addition, an increase or decrease of overtime had a significant impact on exacerbation or improvement of the overwork score and depressive symptoms. These findings indicate that limiting overtime could be useful to maintain good mental health and prevent overwork-related health problems among hospital physicians, by emphasizing the important roles of occupational physicians and health surveillance at workplace, which should be successfully implemented.

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