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Active Job, Healthy Job? Occupational Stress and Depression among Hospital Physicians in Taiwan

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Abstract: This study assessed the levels and association of occupational stress and depression rate among physicians, and to compare physicians' occupational stress with that of Taiwanese employees in other occupations. The subjects were physicians employed at 14 participating regional hospitals in the Around Taiwan Health Care Alliance. Self-administered questionnaires capturing data on demographics, occupational characteristics, occupational stress measured using Job Content Questionnaire (C-JCQ), and health status measured using Taiwanese Depression Questionnaire (TDQ) were sent to eligible physicians. Results revealed that the depression rate (13.3%) was higher than that found in the general population (3.7%) of Taiwan. The mean scores of the JCQ dimensions "work demands" and "job control" were both much higher than those in most occupations in Taiwan. Higher depression scores were found in subjects with higher work demands, 8–10 d of being on duty per month, and more frequent alcohol consumption, while lower depression scores were found in subjects working in the east Taiwan area, with higher job control and with greater workplace social support. On the other hand, gender, smoking, and working hour were not independently correlated with depression, but the interaction of gender and job control also had an independent effect on depression. This study suggests that job stress plays an important role in depression in physicians; it is necessary to pay attention to physicians at high risk of depression, as well as their work environments, for early detection and intervention.

Key words: Depression, Job stress, Karasek's job-strain model, Physician, Survey, Taiwan

Introduction

Adverse mental health conditions among physicians—including stress, burnout, and depression—can result in errors in professional conduct and interfere with the quality of healthcare provision[1–3]. Physicians are usually exposed to high levels of occupational stress resulting from heavy workloads and high levels of time pressure, and those in certain employment positions or specialties are at higher risk of suffering from depression disorders than the general population[4, 5]. High occupational stress and depression within physicians can even lead to higher suicide ideation or suicide rates[6, 7].

Among various risk factors in the work environment, job stress is central to workers' daily lives; its asso-

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ciation with worker mental health has attracted great attention[8–10]. Recently, considerable concern about job stress has given rise to a theoretical approach that focuses on a demand-control-support model of job strain, as proposed by Karasek[11, 12]: it predicts that job strain will occur when psychological work demands are high and the worker's job control is low, while a low level of workplace social support would increase the risk of negative health outcomes. Besides job strain, Karasek's model also postulates that "high work demands, high job control" situations will enhance workers' active learning and lead to a greater internal locus of control. This model has been a centerpiece of current job-stress research, and there has been a growing number of studies that examine depression among employees by deferring to the demands-control-support model[13, 14]; more specifically, there has also been such research into physicians[15, 16]. However, until now, little research has been done on the association between occupational stress and depression among physicians.

In some Western countries, physicians' job characteristics, on the whole, are popularly considered as being more "active" (high demands/high control) compared to other occupations[17]. As for Taiwan, in the past, physicians were generally viewed as having a high-income job that commanded great respect; however, in facing increased pressure resulting from competition within the medical market, their working conditions have changed substantially in recent years. For example, increased workloads, unsatisfactory doctor–patient relationships, and an increase in litigation can result in an increase in work demands; behavior limitations imposed by medical budgets and National Health Insurance payments can reduce physician job control, as can hospital management; and competition among clinics vis-à-vis work and research may lead to a more individualized workforce and an erosion of interpersonal support[18, 19]. Therefore, more and more physicians in Taiwan feel stressed about their jobs, and several incidents of depression and suicide among physicians have caused public shock.

The medical service system in Taiwan can be categorized as being three-tiered: medical centers, regional/local hospitals, and private clinics. Like many developed countries, in Taiwan, the typical job content of a physician includes clinical work, teaching, and medical research. In general, the work climate at medical centers and larger regional hospitals is very challenging and involves more teaching and research; in contrast, physicians at local hospitals and clinics devote more time to clinical work. The condition of medical resource and hospital are also quite different between the rural and urban area. In this study, we utilized data from a cross-hospital survey of employed physicians in various specialties which was conducted by the "Around Taiwan Health Care Alliance (ATHCA)" established in February 2000. The aim of the ATHCA was to share medical and research resources and it comprises 14 hospitals in different levels whose sizes ranging from 43 to 1,006 beds located throughout north, central, south, and east Taiwan. So, this Alliance is a representative choice of sampling for a cross-sectional survey among physicians in Taiwan.

Job stress and depression, as experienced by physicians, can influence their quality of work and the quality of the medical services they offer; as such, it can eventually affect population health. Therefore, it is both essential and urgent to evaluate depression and associated job factors among physicians, to improve their working conditions and their own health. In light of these concerns, this study has three objectives: to assess the levels of occupational stress and depression in physicians, to analyze the relevance and extent of job-stress factors on physician depression, and to understand relative differences in the basic characteristics of job stress between physicians and other occupational groups. With respect to the last objective, we compared our physician survey results with those of a national survey that involved a large sample consisting of various job categories of paid employees to evaluate job stress among physicians and other "active" jobs derived from Karasek's demand-control-support model (also called job-strain model).

Subjects and Methods

Study population and procedure

The study proposal and the questionnaire were approved by the Institutional Review Board of Chang-Gung Memorial Hospital in Keelung, a key member of the ATHCA. To recruit study participants, lists of a total of 1,643 practicing physicians in the 14 participating regional hospitals were supplied by the Around Taiwan Health Care Alliance. We looked to capture survey data from one-third of the physician base. Participants were not selected randomly from the list, but in proportion to the population size of each department. The self-reported questionnaire was sent to each department, accompanied by a cover letter explaining the study purpose. The secretaries or assistants of each department asked for the volunteer physicians to execute the questionnaire. The anonymous questionnaires were collected by the staff members of each department within one week and returned to the Chang-Gung Memorial Hospital in Keelung. We issued a total of 548 questionnaires, and after invalid questionnaires were excluded, 473 respondents (401 males and 72 females)

were available for analysis (the overall response rate was 86.31%), somewhat short of the goal of one-third of all physicians.

In terms of comparing our physician participants with typical Taiwanese employees vis-à-vis job stress, national survey data of psychosocial job stressors were analyzed using the two-digit codes of the Taiwanese standard industrial classification system (e.g., 01 denotes "agriculture and animal husbandry", 51 denotes "eating and drinking places", etc.). The national survey outcome was based on a nationally representative sample of paid employees comprising 15,288 subjects aged 25–65 yr in randomly selected households; that survey had been conducted by the Institute of Occupational Safety and Health (IOSH) of the Taiwanese government in 2004[20, 21].

Measures

Demographic data and work characteristics

A structured questionnaire was administered to capture information on depression status, work stress, and other potentially influential factors with regards to depression, including demographics (gender, age, and marital status), work conditions (average daytime working hours per day and number of days on night-shift duty per month), behavioral factors (smoking, alcohol consumption, and exercise), and occupational status (seniority; position: attending, resident, or intern doctor; location of the hospital: north, central, south, or east Taiwan; physician specialty, classified into one of four categories: (1) internal doctors; (2) surgeons, including obstetrics and gynecology; (3) emergency doctors, dentists, and doctors of traditional Chinese medicine; and (4) other specialists, such as dermatologists, radiologists, psychiatrists, ophthalmologists, etc.

Chinese version of Job Content Questionnaire (C-JCQ)

Occupational stress was measured by the Chinese version of Karasek's Job Content Questionnaire (C-JCQ), which consists of three dimensions: psychosocial work demands (five items), job control (nine items), and workplace social support (eight items). Each item was measured on a four-point Likert scale (1: strongly disagree to 4: strongly agree). As mentioned previously, the JCQ is developed based on Karasek's job-strain model[11, 12]. In the JCQ, the job-control scale includes two sub-components: decision authority (three items) and skill discretion (six items); the workplace social support dimension also contains two sub-components: supervisor support (four items) and coworker support (four items). Karasek's job-strain model has been widely used in job-stress research, often with strongly reliable, valid, and reproducible results[13, 22]. The construct validity has been reported that the four factors extracted by the principal factor analysis (PCA) corresponded very closely to the theoretical constructs in the C-JCQ[13, 22]. In our study, Cronbach's alpha coefficients for the work demands subscale was 0.71, while that for the job control and workplace social support subscale was 0.69 and 0.81, respectively; there were no significant differences in reliability between genders. In addition, the participants' scores on the work demands and job control, as per Karasek's model, were compared to those in the 2004 IOSH national survey, to evaluate job stress according to job category.

Taiwanese Depression Questionnaire (TDQ)

Depression status was assessed using the Taiwanese Depression Questionnaire (TDQ). Because different cultures have different styles of emotional expression, the TDQ integrates some local Taiwanese idioms of depression-related expression and combines other depression scales to form a culturally relevant questionnaire for screening depressed people. The TDQ contains a total of 18 items, such as "*I often feel like crying*" and "*I could not concentrate when doing things*", each measured on a four-point Likert scale (0: strongly disagree to 3: strongly agree). TDQ scores range from 0 to 54, with higher scores indicating higher levels of depression traits. In previous validation of the TDQ with the Beck Depression Inventory (BDI) and the Hamilton Rating Scale for Depression (HRSD), the sensitivity, specificity and reliability of the TDQ was comparable to those of the BDI and the HRSD[23–25] both are internationally-used screening tools for depression in community population; for the TDQ, the optimal cut-off score was set at 19 based on a Receiver Operating Characteristic (ROC) curve analysis[24, 26], and a sensitivity of 0.89 and a specificity of 0.92 was shown based on a cross examination with the Structured Clinical Interview for DSM-III-R Depressive Disorders by psychiatrists[26]. In our study, the Cronbach's alpha coefficient of the TDQ was 0.94, and no significant difference between genders was found.

Statistical analysis

Given that there was no significant differences between genders, in our analyses, data for men and women were combined to increase statistical power. All statistical analyses were performed with SAS software version 9.1.3[27], and any p-value<0.05 was considered statistically significant.

Basic descriptive statistics were calculated to determine the distributions of the demographic, occupational, and behavioral characteristics of the study population. Respondents were divided into depression and

non-depression groups, using the TDQ cut-off score of 19. χ^2 tests were used to compare differences in demographics, occupational status, work conditions, and behavioral factors between the depression and non-depression groups, and then to examine the relationship between the demand-control-support dimensions of Karasek's job strain model and depression. In these analyses, the JCQ scores of work demands, job control, and workplace social support were ranked and divided into tertiles (low, medium, and high). Logistic regression analysis was then applied to investigate the independent effect of each dimension of Karasek's job strain model on depression: gender, age, marital status, smoking, alcohol use, exercise, work hours, days on duty, area of work, and specialty were controlled in the analysis because these variables were known or postulated to predict depression outcomes[8, 28–31]. Actually, we also performed analyses with or without controlling for life style behavior variables or work characteristic variables other than the items of C-JCQ; the results showed that the beta coefficients of independent variables in the reduced models and the full model did not differ noticeably (data not shown); thus, only the results of the full model were presented. In the logistic regression model, categorical independent variables were recoded as dummy variables. Among occupational variables, seniority was not included in the logistic regression model, because it significantly correlated with age and other occupational or job characteristics related to the physician's role in hierarchical work organizations, such as position and job control. For this reason, the inclusion of seniority in the model may cause an over-control problem.

The numbers of participants (401 for male; 72 for female) were not large enough, and it may not have adequate statistical power to perform two separate regression models by each gender. Therefore, we analyzed the effects of interactions between gender and job content (JCQ scores of work demands, job control, and workplace social support were divided into dichotomous categories) for depression in separate analyses to adjust for the variables aforementioned. Wald's χ^2 test statistic was used to test the significance for the interactions.

Concerning data imputation for the inventories used in this study, for the C-JCQ and TDQ items, we used non-missing data to predict the values of missing data. In our preliminary analyses, there were 13 (2.75%) and 16 (3.38%) questionnaires missing data for the C-JCQ and TDQ, respectively. To reduce information loss—and because there were no significant differences between the results with and without the missing data imputation—all missing C-JCQ and TDQ values were replaced with the means of our respondents' available values for each item. However, there were still a few missing responses among the categorized variables—i.e., marital status, specialty, and working hours—that were not filled in.

The mean scores of various occupations in the IOSH 2004 national sample were used to compare with those of our 2007 physician survey outcomes regarding work demands and job control. Fifteen occupations from the national sample are plotted in Fig. 1; data for occupations with a small number of workers (i.e., number of workers <2% of the national sample) were omitted, both because of their lower statistical precision and for the sake of brevity.

Results

The demographic, occupational, and behavioral characteristics of the 473 respondents are summarized in Table 1. Men accounted for 84.77% of the study population, and more than one-half of them were under the age of 40. About one-half of the respondents reported a practice duration of more than eight years. The majority of our respondents were attending doctors (72.09%) and were married (72.72%). Some respondents worked more than 12 h per working day (16.07%) and had more than 10 days of shift work in the month preceding the survey (15.22%). A small proportion of respondents were smokers (5.07%) and habitual consumers of alcohol (4.44%).

After replacing each missing TDQ value with the mean of our respondents' non-missing value, there were 63 (13.32%) subjects whose TDQ score was equal or higher than the cut-off point of 19; they were classified into the "depression" group. The other 410 (86.68%) subjects, whose TDQ scores were each <19, were classified into the "non-depression" group. In comparing the depression and non-depression groups, depression was found to be significantly associated with female gender, a lower position (resident or intern), area of employment (compared to east Taiwan), being single, having more than eight days of shift duty per month, and frequent alcohol use. There were no significant differences with regard to age, department, working hours, and smoking and exercise habits, between the depression and non-depression groups.

To present relative differences in job stress based on job categories, Fig. 1 plots the mean scores of various occupations in the IOSH 2004 national sample, along with the outcomes of our 2007 physician survey regarding work demands and job control vis-à-vis Karasek's job strain model. The means of work demands and job control values in the national sample were 29.94 (SD=3.63) and 61.63 (SD=10.50), and these became the

Table 1. Characteristics of the study participants and comparisons between depression and non-depression group[a]

	Total (n=473)		Non-Depression (n=410)		Depression (n=63)		χ^2 *p*-value
	n	%	n	%	n	%	
Gender							4.15
Male	401	84.77	353	88.03	48	11.97	0.04*
Female	72	15.22	57	79.17	15	20.83	
Age (yr)							1.80
<30	77	16.28	64	83.11	13	16.88	0.62
31–40	201	42.49	173	86.07	28	13.93	
41–50	152	32.13	134	88.16	18	11.84	
>51	43	9.09	39	90.70	4	9.30	
Seniority (Years)							2.06
<2	70	14.80	60	85.71	10	14.29	0.56
3–5	86	18.18	71	82.56	15	17.44	
5–8	77	16.28	67	87.01	10	12.99	
>8	236	49.89	209	88.56	27	11.44	
missing data	4	0.85					
Position							11.87
Attending	341	72.09	307	90.03	34	9.97	<0.001***
Resident/Intern	132	27.91	103	78.03	29	21.97	
Geography							11.05
North	156	32.98	137	87.82	19	12.18	0.01*
Central	65	13.74	52	80.00	13	20.00	
South	179	37.84	150	83.80	29	16.20	
East	73	15.43	71	97.26	2	2.74	
Marital status							8.16
Married	344	72.72	307	89.24	37	10.76	<0.01**
Single	124	26.22	98	79.03	26	20.97	
missing data	5	1.06					
Specialty							2.87
Internal doctor	242	51.16	206	85.12	36	14.88	0.41
Surgeon	98	20.71	84	85.71	14	14.29	
E./ D./ D.T.C[b]	62	13.11	54	87.10	8	12.90	
Others	60	12.68	56	93.33	4	6.67	
missing data	11	2.33					
Working hours (per working day last month)							1.42
<9	180	38.05	158	87.78	22	12.22	0.49
9–12	216	45.67	183	84.72	33	15.28	
>12	76	16.07	68	89.47	8	10.53	
missing data	1	0.21					
Night-shift duty days (last month)							14.13
<4	181	38.27	165	91.16	16	8.83	<0.01**
5–7	101	21.35	93	92.10	8	7.92	
8–10	119	25.16	94	78.99	25	21.01	
>10	72	15.22	58	80.56	14	19.44	
Smoke							3.55
No	449	94.93	393	87.53	56	12.47	0.06
Yes	24	5.07	17	70.83	7	29.17	
Alcohol							11.68
No	452	95.56	397	87.83	55	12.17	<0.001***
Yes	21	4.44	13	61.90	8	38.10	
Exercise							0.41
No	178	37.63	152	85.40	26	14.61	0.52
Yes	295	62.37	258	87.46	37	12.54	
Depression score							
High (≥19)	63	13.32					
Low (<19)	410	86.68					

*p<0.05, **p<0.01, ***p<0.001 for comparison between depression and non-depression group.

[a]The missing values of all the TDQ items were replaced with the mean of our respondents' available values of each item.

[b]E.: emergency doctor, D: dentist, D.T.C: doctor of traditional Chinese medicine.

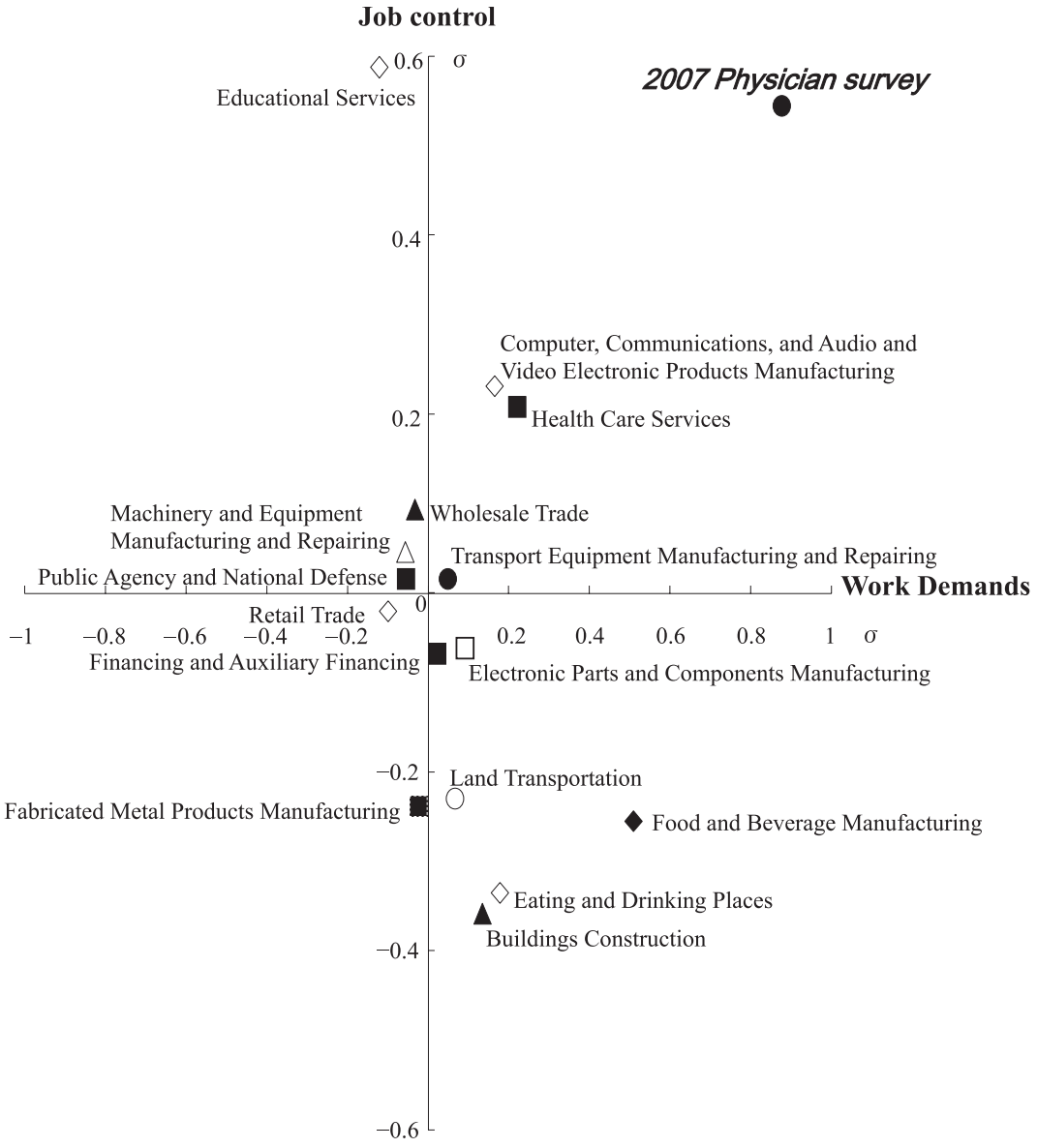

Fig. 1. Comparison of psychosocial job characteristics (work demands, as well as job control according to Karasek's job-strain model), between the 2007 study participants and other job categories in the national survey sample.
National survey source: 2004 Institute of Occupational Safety and Health (IOSH) survey, Taiwan.
N=15,288 Taiwanese paid employees, National mean: work demands 29.94 (SD=3.63); job control 61.64 (SD=10.50).

original values of the X- and Y-axes, respectively. The "high job strain" group is found within the lower right corner, while the "active learning" group is in the upper right. In the national survey, high job strain occupations (i.e., those with high demands and low control) included various physical-labor or highly repetitive jobs, such as building construction, food and beverage manufacturing, and food and drink service, as well as land transportation. On the other hand, the active-learning jobs (high work demands, high job control) included the manufacture of computer/communication products, and healthcare services. Education-service employees had relatively lower work demands and much higher job control. In our physician sample, the mean scores for work demands and job control were 33.16 (SD=5.25) and 67.26 (SD=8.16), respectively. Our physician sample was found to have much higher work demands and job control than the national survey means, as well as those of the whole group of healthcare service workers; the sample mean is located in the far upper right corner of Fig. 1.

Occupational stress findings, as measured by C-JCQ, are summarized in Table 2, along with comparisons of each stress dimension between the depression and non-

Table 2. Association of dimensions of demand-control-support in Karasek's job strain model and depression

	Total (n=473)	Non-depression (n=410)	Depression (n=63)	χ^2 *p*-value
	mean/n (SD/%)	n (%)	n (%)	
Work demands	33.16 (5.25)			18.76
Low	166 (35.10)	150 (90.36)	16 (9.64)	<0.001***
Middle	149 (31.50)	138 (92.62)	11 (7.38)	
High	158 (33.40)	122 (77.22)	36 (22.78)	
Job control	67.26 (8.16)			21.90
Low	144 (30.44)	110 (76.39)	34 (23.61)	<0.001***
Middle	203 (42.92)	180 (88.67)	23 (11.33)	
High	126 (26.64)	120 (95.24)	6 (4.76)	
Workplace social support	22.98 (2.68)			36.00
Low	142 (30.02)	103 (72.54)	39 (27.46)	<0.001***
Middle	274 (57.93)	252 (91.97)	22 (8.03)	
High	57 (12.05)	55 (96.49)	2 (3.51)	

*p<0.05, **p<0.01, ***p<0.01 for comparison between depression and non-depression group.

depression groups. After the scores of the three dimensions "work demands", "job control", and "workplace social support" in the C-JCQ were divided into low, medium, and high groups, higher work demands, lower job control, and lower social support were found to be strongly associated with depression status.

Table 3 presents the results of a logistic regression analysis of occupational stress, with regards to depression (TDQ score ≥19), after adjusting for other associated depression factors, including gender, age, marital status, smoking, alcohol use, exercise, working hours, number of duty days, area of work, and area of specialty. The results showed that subjects with significantly higher depression scores were found to have higher work demands, eight to ten days of shift duty per month, and alcohol use; on the other hand, lower depression scores were found among subjects who worked in east Taiwan, with higher job control or higher workplace social support. The interaction between gender and job control was significant (χ^2=6.63, p=0.010) for depression. On the other hand, we did not find significant effects of the interactions between gender and work demands (χ^2=2.02, p=0.156) or gender and workplace social support (χ^2=0.01, p=0.941) for depression.

Discussion

In this study, we reported the prevalence of depression status and its associated factors among physicians in Taiwan, as well as relative differences in work demands and job control between our study participants and other occupations in a national sample of employees. The results indicated that 13.3% of our surveyed physicians were screened as having depression status, according to the TDQ. After demographics, work conditions, behavioral factors, and occupational status were controlled, higher depression scores correlated with higher work demands, 8–10 d of duty per month, and more frequent alcohol use; moreover, lower depression scores were found in subjects working in the east region, and with higher job control or workplace social support. The interaction of gender with job control also had an independent influence on depression. Cross-occupation comparisons of job characteristics between our study sample and workers of other occupations in Taiwan showed that physicians tended to have much higher work demands and job control than many occupations, including workers in the general healthcare service industry.

JCQ is a widely used international survey instrument for job stress, so it is an appropriate tool for making comparisons between countries or different job categories. The JCQ results in our physician sample were much higher than those of many other Taiwanese employees or the national survey means, and similar to the findings of previous cross-occupational studies[17, 32]. The mean work demands and job control scores among our physician sample in Taiwan are comparable to the results of surveys of physicians in other countries[15, 16], located in the upper-right quadrant of Fig. 1. Such findings may form an important foundation for job-stress research among different occupations.

We assessed the prevalence of depression status among physicians and attempted to make comparisons with other available data; however, existing data relating to TDQ-screened depression in physicians have been very limited. The results of our study suggested that in Taiwan, the prevalence of depression status may be much higher in physicians (13.32%) than in a represen-

Table 3. Multivariate-adjusted odd ratios (ORs) of job stressors on depression estimated by logistic regression analysis[a]

	Total (n=473)		
	Odds Ratio	(95%CI)	*p*-value
Gender			
Male	*(reference)*		
Female	2.25	(0.81–6.25)	0.12
Age			
20–30	*(reference)*		
31–40	1.73	(0.50–6.01)	0.39
41–50	1.87	(0.43–8.24)	0.41
>51	0.46	(0.07–3.26)	0.44
Position			
Attending	*(reference)*		
Resident/Intern	0.69	(0.24–1.99)	0.49
Geography			
North	*(reference)*		
Central	2.09	(0.68–6.48)	0.20
South	1.66	(0.71–3.92)	0.25
East	0.17	(0.03–0.85)	0.03*
Marital status			
Married	*(reference)*		
Single	1.87	(0.68–5.14)	0.22
Department			
Internal doctor	(reference)		
Surgeon	1.54	(0.60–3.96)	0.37
E./ D./ D.T.C[b]	1.10	(0.39–3.08)	0.86
Others	0.83	(0.20–3.39)	0.79
Working hours (last week)			
<9	*(reference)*		
9–12	0.97	(0.46–2.07)	0.94
>12	0.50	(0.17–1.49)	0.21
Night-shift duty days (last month)			
<4	*(reference)*		
5–7	0.71	(0.25–2.02)	0.52
8–10	3.31	(1.29–8.48)	0.01*
>10	1.72	(0.58–5.11)	0.33
Smoke			
No	*(reference)*		
Yes	1.12	(0.27–4.59)	0.88
Alcohol			
Non/social	*(reference)*		
Frequently	9.02	(2.22–36.61)	<0.01**
Exercise			
No	*(reference)*		
Yes	1.52	(0.73–3.19)	0.27
Job control			
Low	*(reference)*		
Middle	0.16	(0.07–0.39)	<0.001***
High	0.11	(0.04–0.31)	<0.001***
Work Demands			
Low	*(reference)*		
Middle	0.90	(0.34–2.40)	0.83
High	2.46	(1.02–5.93)	0.05*
Social Support			
Low	*(reference)*		
Middle	0.38	(0.18–0.81)	0.01*
High	0.11	(0.02–0.55)	<0.01**

*p<0.05, **p<0.01, ***p<0.001.

[a]R-square=0.19, [b]E.: emergency doctor, D.: dentist, D.T.C: doctor of traditional Chinese medicine.

tative sample of 1,552 adults in Taiwan (3.70%)[33]. In some international studies, physicians were found to be vulnerable to affective disorders, including depression; increased suicidal rate has also been reported[5, 6]. The depression lifetime prevalence is 19.5% for self-identified in female physicians in the Women Physician Health Study[34]. Cross-sectional rate of depression could be as high as 24% to 45% in surveys for medicine residents[1, 35]. Our findings agree with these previous studies and suggest that physicians may comprise a high-risk job group for mental illness. Speaking of the quality of healthcare among depressed physicians, there is an empirical study demonstrated that depressed residents made 6.2 times as more medication errors than who were not depressed[1]. So physicians' mental health should be considered an important issue for hospital management as well as health care policy; though we were unable to draw such conclusion from our empirical data.

Concerning risk factors for depression status among physicians, work demands were found to significantly correlate with depression; this finding accords with those of many previous studies[18, 36]. In bivariate analyses (Table 1), we identified being female as a possible risk factor for depression status among physicians; this finding is similar to findings for the general population[37, 38]. The level of position and marital status were also associated with depression. However, after analyzing independent effects by multivariate logistic regression, these three characteristics became non-significant. These factors may all interact highly with each other and be influenced by job stress. For example, a female, single, or lower-position physician may suffer from higher work demands but possess lower power of control, and so depression would strongly correlate with job stress rather than gender, marital status, or their position. Additionally, in this study, alcohol consumption was a strong indicator of depression; this is consistent with past findings on the high comorbidity between alcohol use disorder and major depression[39, 40], in the physician group[41] as well. Our study results appear to generally accord with those of previous studies, regarding the relationship between workload and job stress[30, 42].

On the other hand, lower depression scores were found in subjects working in east Taiwan—a circumstance that could be viewed as a protective factor. This difference may result from obvious inequalities in economic development and urbanization across Taiwan. There are 30 medical centers or regional-education hospitals in Taipei City and Taipei County (2,323 km^2, 2,785 persons/km^2), which is the largest metropolitan center in north Taiwan; in contrast, there are only four regional-education hospitals in the two eastern counties of Hua-Lian and Tai-Tung (8,183 km^2, 70 persons/km^2). The physicians employed in the eastern region may feel less competitive and less stressed in their clinical workloads. With respect to job stress, an appropriate intensity of demands may improve physician motivation and efficacy of work; however, if psychological work demands are overly high, they may result in burnout and lead to depression[43]. In contrast, we found that higher levels of job control and social support may be associated with lower job strain and better health outcomes; these correlations agree with those found in previous studies[11].

The working hours did not show significant correlated with depression in this study. It may result from the generally constant working hours of physicians with their daily routine (e.g. operation, outpatient clinic or inpatient care). There was certain empirical study reported that working hours were significantly associated with mental health, but the relationship was still equivocal[8, 28]. Concerning duty days, a greater number of days on duty may often represent a heavier workload and a greater number of shifts worked per month. Research has indicated that residents with night-float rotation had significantly higher probability to feel moody or depressed than who were with day-time rotation[44]. On the other hand, it had been reported that overtime work was not significantly correlated with depression[28]. During "night-shift duty days", which is the working style of most physicians here in Taiwan, doctors have to work at daytime as usual, and stay in the hospital for duty through the whole night and keep on working in the next day. The specific night shift working style is only seen in physicians in the emergency room. Therefore, the working hour and night-shift duty days may be auxiliary quantitative indicators of work load, but may not entirely reflect the work strain. In the aspect of life style, a rate of smoking among different positions of physicians was reported ranging from about 5 to 7.4%[18, 45]. In our study, the smoking rate was about 5%, and it is similar with empirical studies aforementioned. Although smoking comorbid highly with alcohol consumption in our samples (χ^2=38.40, p<0.001), only alcohol use was independently correlated with depression.

Gender difference in the prevalence of depression has been well-recognized in epidemiological literatures[46]. Nevertheless, our result showed no significantly independent effect of genders from logistic regression model. We further tested the interactions effects of gender and job stress on depression and found that only the interaction between gender and job control was significant for depression. It has been shown there was a significant

difference in the job control degree between genders in our national sample[21]. In another study for a sample of hospital-based Chinese physicians, job control was significantly higher among men, and it was related to their physical health[15]. The result of our study demonstrated that the effect of job control may also be different between genders among physicians relating to their mental health.

The bio-psycho-social model is a popular framework that explains the etiology of depression[47, 48], in which the biological system refers to the molecular substrates of disease, the psychological system refers to a vulnerable personality or negative cognition, and the social system includes environmental, cultural, and familial influences. Besides well-established biological and psychological factors, social factors also play an important role in causing depression[32, 49], and our findings support the notion that job stress may be a key element in the social causality between work environment and depression among workers. Numerous studies demonstrated the relationship between job stress and depression[36, 49, 50], and one study indicated that burnout was a mediator between job stress and both the occurrence/exacerbation of depressive symptoms and poor physical health[51]. Our study of a physician population showed that work demands, job control, and workplace social support are still significantly associated with depression, even after controlling for many other demographic, occupational, and job characteristics.

This study has some limitations. First, though the participants were from 14 hospitals from different levels throughout Taiwan, physicians in local clinics were not included. Furthermore, the subjects were not randomly selected and the reasons for non-participating and non-response are not known; physicians who suffer most from stressful work or severe depression may not have the willingness or motivation to participate in our study. On the other hand, physicians who were more depressive or unsatisfied with their jobs might have greater motivation to participate and express their discontent. As a result, data pertaining to job stress and depression status should be discreet, and selection bias cannot be ruled out. Second, information bias may result from some data missing from the executed questionnaires. Although the missing JCQ and TDQ items were replaced with the means of our respondents' available values, the small amount of missing data might have influenced the study results to a certain extent. Third, Karasek's job strain model may not sufficiently address all dimensions of physicians' job stressors[19], such as reward systems and doctor-patient relationships, even though significant differences of salary and interpersonal relationships may partially be explained by physicians' seniority, specialty, and employment position, which have been included in this study. Fourth, our data are solely self-reported; although the questionnaires were executed anonymously, we cannot rule out all possibility of biased estimates. Besides, in this study, the internal consistency for work demands (0.71) and job control (0.69) scales are not very high; low internal consistency for the same JCQ scale was also found in other populations[19], indicating that this scale should be further improved. Fifth, because TDQ is a screening rather than a diagnostic tool, more study is required to determine the accurate prevalence rate of depression. Finally, due to this study's cross-sectional design, our findings can only be considered correlations rather than causal relationships.

Despite these limitations, the strengths of this study compared to referential international studies[4, 15, 16] lie in its wide distribution of physician samples include various specialties, plentiful depression risk factors and work condition indicators, and comparisons between JCQ scores with other occupations. Although the results were from survey of volunteer physicians, the major contributions of this pilot study are its reporting of an estimated rate of depression, the status of occupational stress, and the risk and protective factors of depression status among physicians in Taiwan, none of which have been presented before. In this study, we demonstrate that all dimensions of Karasek's job strain (demand-control-support) model were significantly associated with the depression status among physicians—such a typical group of "active" job workers. Karasek's job strain model also provides a theoretical basis for organizational or policy changes, to improve physicians' work conditions. For example, hospital management should ensure that physicians' reasonable work demands fit with their individual capabilities and resources; strategies can be used to efficiently promote mutual social support within work groups.

Mental well-being among physicians is closely related to healthcare provision to patients[1–3]; however, their health status is often neglected by medical management and researchers[52]. Though physicians are regarded as "helpers" in society, and their jobs usually involve active problem-solving for patients, they may be reluctant to seek medical attention for themselves, especially for mental health disorders such as depression. The competitive nature of medicine appears to discourage them from seeking help. This study provides references for fellow medical colleagues, to recognize early symptoms and keep close attention to physician mental health.

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