Tohoku J. Exp. Med., 2018, **245**, 167-177

Job Stress Factors Affect Workplace Resignation and Burnout among Japanese Rural Physicians

Yasuaki Saijo,[1] Eiji Yoshioka,[1] Sharon J.B. Hanley,[2] Kazuyo Kitaoka[3] and Takahiko Yoshida[1]

[1]Department of Social Medicine, Asahikawa Medical University, Asahikawa, Hokkaido, Japan
[2]Department of Obstetrics and Gynecology, Hokkaido University Graduate School of Medicine, Sapporo, Hokkaido, Japan
[3]Faculty of Health Sciences, Komatsu University, Komatsu, Ishikawa, Japan

Shortage of healthcare workers is a global problem. It is important to clarify factors, including job stress, that influence workplace resignation and factors that cause burnout among rural physicians. The study was designed as a cross-sectional questionnaire survey. We sent questionnaires to town or village hospitals and clinics (n = 1,898) in Hokkaido, Tohoku, Shikoku, and Kyushu and Okinawa. The number of participants was 509. Of these 7.7% were female and 21.6% were < 50 years. Internal or general medicine physicians were asked about personal and job factors, job stress based on the demand-control-support model, intention to resign from current position, and burnout evaluated using the Maslach Burnout Inventory-General Survey. Overall, 10.4% of the participants intended to resign, and 21.8% was defined as burnout positive. In the multivariate logistic regression analysis, dissatisfaction with income (OR, 3.63; 95% CI, 1.63-8.10), having one's hometown in another town or village in the same prefecture (OR, 3.53; 95% CI, 1.18-10.62) were significantly related to intention to resign, while high job control (OR, 0.72; 95% CI, 0.58-0.88) had a significantly protective effect. In the multivariate analysis, high job demand (OR, 1.48; 95% CI, 1.28-1.72) was significantly related to burnout, and high job control (OR, 0.66; 95% CI, 0.55-0.78) and high support from co-workers (OR 0.88, 95% CI, 0.78-1.00) had a significantly protective effect. Improving job stress factors, especially job control, and taking into consideration physicians' hometown and income may be important factors to prevent resignation from a current position and burnout among Japanese rural physicians.

Keywords: burnout; hometown; intention to resign; job stress; rural medicine
Tohoku J. Exp. Med., 2018 July, **245** (3), 167-177.

Introduction

Shortage of healthcare workers is a global problem, in both developing and developed countries, and poor access to physicians may be linked to poor health outcomes (Saijo et al. 2018). Japanese rural areas have suffered from a shortage of physicians for several decades (Tanihara et al. 2011). Since it has been reported that a large number of physicians who grew up in rural areas subsequently stayed in rural areas (Magnus and Tollan 1993), the Japanese government started expanding the number of medical school entrance places with a regional quota from 2008 (Matsumoto et al. 2016). However, since Japanese medical education lasts six years, and several years more is needed to be a full-fledged physician, making sure that those students who enter medical school as part of the rural quote actually continue to work as rural physicians is necessary. Therefore, elucidation of factors affecting resignation from positions by doctors in rural areas may be helpful to prevent a worsening of the rural physician shortage.

Burnout occurs after prolonged exposure to chronic emotional and interpersonal job stress, and is defined as a state of emotional exhaustion combined with cynicism (also termed depersonalization) and with reduced professional efficacy (Maslach et al. 2001, 2016; Schaufeli et al. 2009). One report from the United States found that physicians had a significantly higher burnout prevalence compared to the general working population, and that burnout was more prevalent among general internal medicine and family medicine physicians (Shanafelt et al. 2012). Physicians' burnout status has been reported to be associated with intention to change jobs (Soler et al. 2008) and medical error (Prins et al. 2009; Balch and Shanafelt 2011). Thus, since burnout prevention has benefits for patient, physicians, and health care systems in general, we need to elucidate potential risk factors for rural physician burnout, in order to protect rural

Received May 21, 2018; revised and accepted June 14, 2018. Published online July 11, 2018; doi: 10.1620/tjem.245.167.
Correspondence: Yasuaki Saijo, M.D., Ph.D., Department of Social Medicine, Asahikawa Medical University, 2-1-1-1 Midorigaoka-higashi, Asahikawa, Hokkaido 078-8510, Japan.
e-mail: y-saijo@asahikawa-med.ac.jp

health care systems.

The demand-control-support (DCS) model is one of the major job-stress model that is commonly used in occupational health settings. It has two dimensions, job demand and job control, with social support being included as a third dimension (Karasek 1979; Johnson et al. 1989). The model defines high stress, unhealthy jobs as those with high demand and low control conditions, while high social support has a buffering effect. Job demand represents the psychological stressors in the work environment. These include factors such as: time pressures, amount of work, and degree of concentration required. Low control jobs include those with reduced decision-making autonomy. In the DCS model, high job demands, low job control and low social support at work leads to high work strain affecting psychological and job-related well-being.

Among German junior doctors, job autonomy, covering the aspect of job control was significantly related to intention to leave clinical practice, while social support and workload were not (Degen et al. 2014). A Finnish physicians study reported that high job control mitigated the positive association that distress and sleeping problems had with intention to change profession (Heponiemi et al. 2009). In our previous study of Japanese physicians, high job strain was significantly related to burnout, and lower support from co-workers was another significant factor (Saijo et al. 2013). A US study of pain medicine physicians reported that job demand was significantly related to emotional exhaustion, and that co-worker support was significantly related to personal accomplishment (Kroll et al. 2016). Thus, effects of each JDC model factor on intention to resign and burnout among physicians have not had consistent results, and factors, including the JDC model factors, affecting intention to resign and burnout among rural physicians, to our knowledge, have not been investigated.

Consequently, it is important to clarify factors including DCS model factors that influence intention to resign from a current position, as well as factors related to burnout among rural physicians. In our pervious study, participants were restricted to alumni from one medical school, and included urban physicians (Saijo et al. 2013). The aims of this study were to elucidate relationship characteristics, work burden, and the DCS factors including job demand, job control, and social support from supervisors and co-workers on the intention resign from a current position, as well as factors associated with burnout in Japanese rural physicians.

Methods

Participants

We selected all towns and villages in four regions of Japan – Hokkaido, Tohoku, Shikoku, and Kyushu and Okinawa, located far from the capital city of Tokyo. Fukuoka prefecture in Kyushu was excluded because some towns and villages adjacent to Fukuoka City are urbanized. We sent self-administered postal questionnaires to all the clinics and hospitals there aimed at internal medicine or general medicine, except those who were working at universities; local health centers; health facilities for the elderly; mobile clinics, rural outreach clinics (because they were not for the general population nor did they have physicians who worked four days per week or more); or in the Self-defense force in October 2017 (n = 1,898: listed in the Regional Bureau Health and Welfare of each prefecture). We asked full-time internal or general medicine physicians in each institute to complete the questionnaire. First, we asked whether there was at least one internal or general medicine physician working full-time (for four-days per week or more), and if the answer was yes, we then asked them to fill out the questionnaire. If the answer was no, we asked them to indicate this and return the questionnaire blank. Seven questionnaires were returned as 'addressee unknown', and one was rejected as unwilling to take part, and 80 replied no full-time (four days per week or more) physicians there. The final number of participants was 509 (28.1% of the total valid number (1,811) which excluded the seven with no valid address and eighty with no full-time physician).

Demographics and work-related factors

The questionnaire included information on sex, age (ranges: ≤ 29, 30-39, 40-49, 50-59, 60-69, ≥ 70 years old), marital status, specialty (general or specific internal medicine), hometown where participant grew up until the age of 15 years (the same town or village as the current one, other town or village in the same prefecture, a city in the same prefecture, a town or village in another prefecture, a city in another prefecture), type of institute (hospital (20 or more beds) or clinic (less than 20 beds or without beds), class of position (high: doctor with his/her own practice, president, director; low: manager, staff, resident), medical school admission type (general, selective admission for community medicine and/or scholarship with obligations), rural community medicine practice during medical school, working hours (≤ 39 h, 40-49 h, 50-59 h, 60-79 h, ≥ 80 h/week), night duty (none, 1-7, ≥ 8/month), on call duty (non, 1-7, ≥ 8 days/month), days off (non, 1-7, ≥ 8 days/month), income satisfaction, satisfaction of opportunity for training or attending medical conferences, and work-life balance satisfaction.

The questionnaire also contained questions on smoking status (smoker, ex-smoker, non-smoker), alcohol intake (none, 1-3, 4-5, 6-7 times per week), and job satisfaction, but these were only used for multiple imputation of missing values (not used for odds ratio (OR) analyses), because smoking and alcohol did not seem to be causes or risk factors of intention to resign from a current position, while job dissatisfaction was strongly related to intention to resign.

Intention to resign

The outcome "intention to resign from current job" was measured using the query "Do you want to continue working at the current hospital or clinic?" with four response choices: "want to continue," "somewhat want to continue," "somewhat want to resign," and "want to resign." The latter two responses were defined as "intention to resign" positive.

Job stress and social support

The DCS model has been widely used in occupational health settings and with a wide range of professions, including healthcare workers, and can quantify stress conditions. The Brief Job Stress Questionnaire (BJSQ) was used to evaluate two job stress dimensions

(job demand and job control) and social support from supervisors, co-workers, and family and/or friends (Shimomitsu et al. 2000), based on the DCS model (Karasek 1979; Johnson et al. 1989). Many practical occupational health evaluation and occupational health studies in Japan have adopted the BJSQ (Suwazono et al. 2008; Saijo et al. 2013, 2014, 2016; Enoki et al. 2017). The job demand portion is comprised of three factors: (1) You have to do an enormous amount of work, (2) You cannot complete all your work in the allotted time, and (3) You have to work very hard. In addition, there were three factors on job control: (1) You can work at your own pace, (2) You can decide the order in which you do your work and the way you do it, and (3) You can provide your opinions on the work strategy of your workplace. The responses were scored on a 4-point Likert-type scale (1 = agree; 2 = somewhat agree; 3 = somewhat disagree; and 4 = disagree). To evaluate job demand and job control, the reversed total scores for the job demand and control questions were used. Thus, higher scores denoted higher job demand or control.

Social support from supervisors, co-workers, and family/friends was also evaluated using three factors: (1) You can often communicate with supervisors/co-workers, (2) You can strongly rely on supervisors/co-workers when you have problems, and (3) Your supervisors/co-workers are prepared to spend their time on your personal problems. The responses to these items were scored on a 4-point Likert-type scale (1 = agree; 2 = somewhat agree; 3 = somewhat disagree; and 4 = disagree). To evaluate social support from supervisors and co-workers, the reversed total score was calculated for each of the three questions with higher scores denoting higher social support (Otsuka et al. 2009; Saijo et al. 2013). Cronbach's alpha coefficients for the BSJQ subscales ― job demand, job control, and social support from supervisors, from co-workers, and from family/friends, were 0.81, 0.74, 0.95, 0.86, and 0.86, respectively. Support from family/friends was only used for multiple imputation of missing values because we selected family life satisfaction as an independent variable and needed to restrict independent variables owing to the small sample size.

Burnout

Burnout is a psychological syndrome in response to chronic interpersonal stressors on the job, and, as previously mentioned, the Physicians' burnout status was associated with intention to change jobs (Soler et al. 2008), and medical error (Prins et al. 2009; Balch and Shanafelt 2011). The Japanese version of the Maslach Burnout Inventory-General Survey (MBI-GS) was used to evaluate burnout (Maslach and Jackson 1981; Kitaoka-Higashiguchi et al. 2004a, b; Maslach et al. 2016). The questionnaire has 16 items, and its three subscales are exhaustion (5 items), cynicism (5 items) and professional efficacy (6 items). Each item was scored using a 7-point Likert-type scale ranging from 'never' (0 points) to 'every day' (6 points), based on the frequency of occurrence. The total scores for each subscale were divided by the number of items on the subscale; higher exhaustion and cynicism scores, and a lower professional efficacy score denote higher degrees of burnout. Cronbach's alpha coefficients for exhaustion, cynicism and professional efficacy were 0.92, 0.84 and 0.86, respectively. Since cut-offs for a general Japanese population have not been estimated, each subscale was tertilized (Saijo et al. 2014). The cut-offs for exhaustion, cynicism and professional efficacy in our study were > 3.2, > 1.8, and ≤ 2.84, respectively, and the upper tertiles of exhaustion and cynicism, and the lower tertile of professional efficacy were defined as subscale positives. Then, on the basis of the common burnout process indicating that exhaustion comes first, followed by cynicism and reduced professional efficacy, participants who were at least exhaustion positive and/or cynicism positive, professional efficacy positive were defined as burnout positive (Brenninkmeijer and VanYperen 2003; Kitaoka-Higashiguchi et al. 2009).

Statistical analysis

Of the participants, 17.1% had missing data for one or more of the variables. On the basis of the "missing at random" (MAR) assumption, we used multiple imputations (20 imputed datasets). The variables included in the imputation model were as follows: sex, age, smoking, alcohol habit, marital status, specialty, hometowns where they mainly lived until the age of 15, type of institute, position, medical school admission type, satisfaction of opportunity for training or medical conference, rural community medicine practice during medical school, working hours, night duty, on call, day off, income satisfaction, family life satisfaction, job satisfaction, intention to resign, the scores for job demand, control, support from supervisors, co-workers and family/friends, and scores for exhaustion, cynicism and professional efficacy. After the imputation was completed, burnout positive was established for those participants with one or more missing value from the MBI-GS -item scores.

Crude ORs of demographics, work-related factors, job demand, control, and supports from supervisors and co-workers for intention to resign and burnout were analyzed by univariate logistic regression analysis. We then conducted multivariate logistic regression analyses with intention to resign and burnout as dependent variables adjusted for sex, age, specialty, hometown where they mainly lived until the age of 15, type of institute, position, medical school admission type, working hours, night duty, income satisfaction, and family life satisfaction, scores for job demand, control, supports from supervisors and co-workers.

In multivariate analyses, since the sample size was not so large, several variables were omitted in the models. Because 'community medicine practice during medical school' and 'medical school admission type' had unexpectedly significant crude odds ratios (ORs) for intention to resign, and they were correlated with age (those youngers had more community medicine practice during medical school and had less 'general' admission type), they were not used in the multivariate models. In the work burden four variables – working hours, night duty, on call, day off –, the latter two were not introduced in the models because they had lower crude ORs compared with the former two variables.

Since the workload variables we selected such as 'working hours', and 'night duty', may be intermediate variables of 'high job demand' and 'low job control,' we constructed the following three models:

Model 1 – sex, age, specialty, home town where they mainly lived until the age of 15, type of institute, position, working hours, night duty, income satisfaction, and work-life balance satisfaction;

Model 2 – sex, age, specialty, home town where they mainly lived until the age of 15, type of institute, position, income satisfaction, work-life balance satisfaction, and the scores of jobs demand, control, and support from supervisors and co-workers;

Model 3 – sex, age, specialty, home town where they mainly lived until the age of 15, type of institute, position, working hours, night duty, income satisfaction, work-life balance satisfaction, and the scores of job demand, control, and support from supervisors and co-

workers. In all three models, all 509 participants were analyzed because the multiple imputation method was used. Because we did not have an a priori hypothesis of interaction effects, and the sample size of the present study was not so large, interaction terms were not analyzed.

P values < 0.05 were considered statistically significant. All calculations were conducted using IBM SPSS Statistics 25.0 for Windows (SPSS Inc., Chicago, IL, USA).

This study was approved by the Institutional Ethical Board for Epidemiological Studies at Asahikawa Medical University (No. 17132: September 30, 2017).

Results

Table 1 shows demographic and work-related factors, intention to resign, and burnout positive. Table 2 shows the BJSQ and MBI-GS scores. Of the participants, 10.4% of the participants intended to resign, and 21.8% was defined as burnout positive.

Table 3 shows the crude ORs for intention to resign. Age, marital status, hometown, institution type, position, community medicine practice during medical school admission type, working hours, night duty, on call, income satisfaction, satisfaction of opportunity for training or medical conference, work-life balance satisfaction, and job control were all significant.

Table 4 shows the crude ORs for burnout positive. Age, working hours, night duty, on call, income satisfaction, satisfaction of opportunity for training or medical conference, work-life balance satisfaction, job demand, job control, and support from co-workers were all significant.

Table 5 shows adjusted ORs for intention to resign. ORs were significantly higher for those aged 30 to 39 years age in Models 2 and 3 (Model 3: OR, 5.17; 95% confidence interval (CI), 1.25-21.31: reference, 70 years age or more). Dissatisfaction with income had consistently and significantly higher ORs (Model 3: OR, 3.63; 95% CI, 1.63-8.10). In the hometown variable, 'other town or village in the same prefecture' had consistently and significantly higher ORs (Model 3: OR, 3.53; 95% CI, 1.18-10.62: reference, the same town or village). In the BJSQ variables, job control had significantly lower ORs (Model 3: OR, 0.72; 95% CI, 0.58-0.88). In Model 3, where the analysis was restricted to male physicians, statistical significance did not change (data not shown).

Table 6 shows adjusted ORs for burnout positive. ORs were significantly higher for those aged 30 to 39 years age in Models 2 and 3 (Model 3: OR, 5.82; 95% CI, 1.50-22.53; reference, 70 years age or more). Dissatisfaction with opportunity for training or ability to attend medical conference had significantly higher ORs in Model 1, but not in Models 2 and 3. Dissatisfaction with work life balance had consistently and significantly higher ORs in all the Models (Model 3: OR, 2.77; 95% CI, 1.48-5.19). In the BJSQ variables, job demand had significantly higher ORs (Model 3: OR,1.48; 95% CI, 1.28-1.72), and job control had significantly lower ORs (Model 3: OR, 0.66; 95% CI 0.55-0.78), and support from co-workers had significantly lower ORs (Model 3: OR, 0.88; 95% CI, 0.78-1.00). Once again, in Model 3, where the analysis was restricted to male physicians, statistical significance did not change (data not shown).

Discussion

The aims of this study were to elucidate the relationships between characteristics of work burden, and DCS factors on intention to resign and burnout among Japanese rural physicians. We found significant relationships in lower age, living in a town or village in the same prefecture other than the hometown', dissatisfaction with income, and low job control on intention to resign, and significant relationships were found with lower age, dissatisfaction with work-life balance, high job demand, low job control, and low support from co-workers for burnout.

Having one's hometown in an 'other town or village in the same prefecture from the current job place,' was significantly related with intention to resign. Since the reference category was 'the same town or village' as the current job place, the result means that working in a town or village that was not a doctor's hometown even if it was in the same prefecture was against rural doctors' wishes. In one Norwegian study where the nation was divided into north (urban) and south (rural), it was found that physicians who spent their youth in the north (rural area), subsequently stayed in the north (rural area) (Magnus and Tollan 1993). However, one study of Japanese rural doctors reported that having a rural origin was not related to intention to continue to their career in a rural area in a multivariate analysis (Matsumoto et al. 2005). Though the Japanese government has started expanding the number of medical school entrance exams with a reginal quota since 2008 as previously mentioned (Matsumoto et al. 2016), the scholarships are mainly provided by prefectures. Thus, rural medicine has been considered as a unit of the prefecture. However, working in the same town or village where one grew up may have important meaning for doctors, especially those who grew up in a town or village.

High job control had significant protective effects on intention to resign and burnout in our study. Systematic reviews have shown that high job control is protective for common mental disorders and burnout symptoms (Stansfeld and Candy 2006; Nieuwenhuijsen et al. 2010; Aronsson et al. 2017). One study of Chinese physicians reported that low job control was one of the most significant predictor of burnout (Wang et al. 2014). Another study of Finish physicians reported that high job control was independently related to lower intention to change profession (Heponiemi et al. 2009; Kuusio et al. 2013). In our study, job control was the only DCS model factor which was consistently related to intention to resign and burnout. High job control could be improved by giving workers opportunities to fully use and develop their skills, and a stronger voice in decision making (Heponiemi et al. 2009). In our study, dissatisfac-

Table 1. Characteristics.

		n	%
Sex	Female	39	7.7
	Male	464	91.2
	Unknown	6	1.2
Age	-29y	7	1.4
	30-39y	40	7.9
	40-49y	63	12.4
	50-59y	153	30.1
	60-69y	183	36.0
	70y-	59	11.6
	Unknown	4	0.8
Smoking status	Smoker	30	5.9
	Ex-smoker	219	43.0
	Non-smoker	256	50.3
	Unknown	4	0.8
Alcohol consumption	Non	185	36.3
	1-3/w	112	22.0
	4-5/w	78	15.3
	6-7/w	129	25.3
	Unknown	5	1.0
Marital status	Unmarried	48	9.4
	Married	457	89.8
	Unknown	4	0.8
Specialty	General	441	86.6
	Specific	67	13.2
	Unknown	1	0.2
Hometown	The same town or village	150	29.5
	Other town or village in the same prefecture	83	16.3
	A city in the same prefecture	111	21.8
	A town or village in other prefectures	62	12.2
	A city in other prefectures	100	19.6
	Unknown	3	0.6
Type of Institute	Hospital	114	22.4
	Clinic	392	77.0
	Unknown	3	0.6
Position	Doctor with his/her own private practice, president, director	448	88.0
	Manager, staff, resident	56	11.0
	Unknown	5	1.0
Medical school admission	General	418	82.1
	Selective admission for community medicine and/or Scholarship of its obligation	82	16.1
	Unknown	9	1.8
Community medicine practice during medical school program	Community practice (–)	380	74.7
	Community practice (+)	124	24.4
	Unknown	5	1.0
Working hours (per week)	-39h	67	13.2
	40-49h	196	38.5
	50-59h	104	20.4
	60-79h	84	16.5
	80h-	48	9.4
	Unknown	10	2.0
Night duty	None	341	67.0
	1-7/m	110	21.6
	8-/m	49	9.6
	Unknown	9	1.8
On call	None	277	54.4
	1-7/m	164	32.2
	8-/m	57	11.2
	Unknown	11	2.2
Days off	None	19	3.7
	1-7/m	392	77.0
	8-/m	92	18.1
	Unknown	6	1.2
Income satisfaction	Satisfied	419	82.3
	Dissatisfied	81	15.9
	Unknown	9	1.8
Opportunity for training or attending medical conferences	Satisfied	287	56.4
	Dissatisfied	215	42.2
	Unknown	7	1.4
Work-life balance	Satisfy	421	82.7
	Dissatisfied	80	15.7
	Unknown	8	1.6
Intention to resign	Negative	449	88.2
	Positive	53	10.4
	Unknown	7	1.4
Burnout positive	Negative	370	72.7
	Positive	111	21.8
	Unknown	28	5.5

Table 2. Job stress, social support, and burnout points.

	n	Mean		SD
Job stress				
Demand	496	8.5	±	2.4
Control	498	9.5	±	1.8
Support				
Supervisor support	502	4.3	±	2.4
Co-worker support	494	7.1	±	2.4
Burnout				
Exhaustion	504	2.6	±	1.6
Cynicism	495	1.6	±	1.3
Professional efficacy	493	3.5	±	1.4

Table 3. Crude odds ratios for intention to resign.

	OR	95% CI	P
Male (vs. female)	1.03	0.35-3.03	0.951
Age			
-29y	5.55	0.98-31.35	0.052
30-39y	6.46	2.11-19.76	0.001
40-49y	1.34	0.40-4.49	0.633
50-59y	0.83	0.28-2.50	0.741
60-69y	0.76	0.26-2.26	0.622
70y-	1.00		
Married (vs. unmarried)	0.40	0.19-0.87	0.020
General (vs. specific)	4.19	1.00-17.64	0.050
Hometown			
The same town or village	1.00		
Other town or village in the same prefecture	5.11	2.02-12.88	0.001
A city in the same prefecture	2.70	1.04-7.02	0.042
A town or village in other prefectures	2.61	0.87-7.81	0.087
A city in other prefectures	1.79	0.63- 5.07	0.275
Clinic (vs. hospital)	0.36	0.20-0.65	0.001
Lower position	3.47	1.74-6.90	< 0.001
Medical school admission-General (vs. Selective admission for community medicine and/or Scholarship of its obligation)	0.32	0.17-0.59	< 0.001
Community medicine practice during medical school	3.03	1.68-5.47	< 0.001
Working hours (per week)			
-39h	1.00		
40-49h	1.84	0.52-6.51	0.342
50-59h	1.75	0.45- 6.85	0.421
60-79h	4.58	1.27- 16.49	0.020
80h-	6.27	1.65-23.86	0.007
Night duty			
None	1.00		
1-7/m	3.26	1.70-6.24	< 0.001
8-/m	4.14	1.86-9.20	< 0.001
On call			
None	1.00		
1-7/m	1.21	0.63-2.32	0.575
8-/m	2.78	1.30-5.96	0.008
Days off			
None	2.51	0.74-8.53	0.139
1-7/m	0.87	0.42-1.82	0.714
8-/m	1.00		
Income satisfaction (dissatisfied vs. satisfied)	4.65	2.52-8.57	< 0.001
Opportunity for training or attending medical conferences (dissatisfied vs. satisfied)	2.11	1.18-3.79	0.012
Work-life balance (dissatisfied vs. satisfied)	3.20	1.70-6.01	< 0.001
Job stress questionnaire			
Demand	1.13	0.99-1.28	0.070
Control	0.67	0.57-0.79	< 0.001
Supervisor support	1.10	0.99-1.22	0.078
Co-worker support	0.96	0.86-1.08	0.511

Table 4. Crude odds ratios for burnout.

	OR	95% CI	P
Male (vs. female)	0.74	0.35-1.53	0.414
Age			
-29y	2.63	0.45-15.21	0.281
30-39y	3.02	1.06-8.57	0.038
40-49y	2.01	0.75-5.41	0.168
50-59y	2.45	1.02-5.89	0.045
60-69y	2.12	0.90-5.03	0.087
70y-	1.00		
Married (vs. unmarried)	1.11	0.54-2.29	0.785
General (vs. specific)	1.13	0.60-2.12	0.702
Hometown			
The same town or village	1.00		
Other town or village in the same prefecture	1.11	0.60-2.06	0.733
A city in the same prefecture	0.72	0.40-1.32	0.288
A town or village in other prefectures	1.00	0.50-2.02	0.991
A city in other prefectures	0.85	0.46-1.56	0.599
Clinic (vs. hospital)	0.63	0.40-1.01	0.056
Lower position	1.22	0.65-2.28	0.546
Medical school admission-General (vs. Selective admission for community medicine and/or Scholarship of its obligation)	1.29	0.71-2.32	0.402
Community medicine practice during medical school	1.07	0.66-1.73	0.791
Working hours (per week)			
-39h	1.00		
40-49h	1.37	0.64-2.95	0.423
50-59h	1.36	0.59-3.13	0.472
60-79h	2.55	1.12-5.78	0.026
80h-	5.23	2.17-12.61	< 0.001
Night duty			
None	1.00		
1-7/m	2.01	1.23-3.28	0.005
8-/m	3.23	1.73-6.05	< 0.001
On call			
None	1.00		
1-7/m	1.13	0.71-1.81	0.607
8-/m	2.64	1.44-4.83	0.002
Days off			
None	2.62	0.93-7.35	0.068
1-7/m	1.00	0.57-1.72	0.985
8-/m	1.00		
Income satisfaction (dissatisfied vs. satisfied)	1.94	1.16-3.24	0.012
Opportunity for training or attending medical conferences (dissatisfied vs. satisfied)	2.20	1.44-3.36	< 0.001
Work-life balance (dissatisfied vs. satisfied)	4.58	2.77-7.59	< 0.001
Job stress questionnaire			
Demand	1.51	1.34-1.69	< 0.001
Control	0.60	0.52-0.69	< 0.001
Supervisor support	0.98	0.90-1.07	0.647
Co-worker support	0.85	0.77-0.92	< 0.001

tion with training opportunities or attending medical conferences was significantly related to burnout in Model 1, but after adjustment for DCS model factors, statistical significance disappeared in Models 2 and 3. Since lower control can include insufficient opportunity for training or attending medical conferences, those confounding factors may reduce the effect of dissatisfaction with training opportunities or attending medical conference on burnout in the multivariate analyses. However, training and education had been reported as one of the important factor for General Practitioner recruitment and retainment (Young and Leese 1999). Therefore, countermeasures which can increase rural physicians' job control including increasing opportunities for training or attending medical conferences should be considered to prevent them leaving their job. In our previous study, rural hospital physicians had higher job control compared to those working in an urban setting (Saijo et al. 2013). However, since demands on health care and its con-

Table 5. Adjusted odds ratios for intention to resign.

	Model 1			Model 2			Model 3		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Male (vs. female)	1.19	0.31-4.64	0.802	1.51	0.37-6.16	0.567	1.33	0.31-5.65	0.702
Age									
-29y	4.64	0.60-35.69	0.141	5.92	0.76-46.13	0.090	6.26	0.70-56.37	0.102
30-39y	3.31	0.85-12.94	0.085	5.74	1.47- 22.46	0.012	5.17	1.25-21.31	0.023
40-49y	0.81	0.19-3.41	0.768	1.07	0.25-4.53	0.930	0.95	0.21-4.29	0.947
50-59y	0.60	0.17-2.10	0.424	0.59	0.17- 2.03	0.405	0.56	0.16-2.02	0.375
60-69y	0.82	0.24-2.74	0.743	0.85	0.25-2.87	0.790	0.86	0.24-3.02	0.812
70y-	1.00			1.00			1.00		
Married (vs. unmarried)	3.64	0.78-17.13	0.102	3.27	0.69-15.53	0.136	3.38	0.70-16.21	0.128
General (vs. specific)	0.97	0.35-2.67	0.948	0.98	0.36-2.66	0.972	0.86	0.31-2.39	0.766
Hometown									
The same town or village	1.00			1.00			1.00		
Other town or village in the same prefecture	4.13	1.41-12.08	0.010	3.67	1.24-10.86	0.019	3.53	1.18-10.62	0.025
A city in the same prefecture	1.91	0.64-5.69	0.244	1.65	0.55-4.99	0.375	1.58	0.51-4.85	0.429
A town or village in other prefectures	2.94	0.88-9.86	0.081	2.88	0.85-9.72	0.088	2.88	0.84-9.89	0.092
A city in other prefectures	0.97	0.29-3.22	0.961	1.00	0.29-3.41	0.994	0.89	0.26-3.10	0.853
Clinic (vs. hospital)	0.64	0.26-1.60	0.340	0.47	0.21-1.04	0.063	0.64	0.25-1.64	0.353
Lower position	2.03	0.80-5.19	0.138	1.84	0.65-5.18	0.248	2.03	0.71-5.82	0.189
Working hours (per week)									
-39h	1.00						1.00		
40-49h	1.45	0.36-5.81	0.597				1.62	0.38-6.88	0.511
50-59h	1.40	0.30-6.54	0.667				1.63	0.32-8.45	0.559
60-79h	1.81	0.39-8.35	0.449				2.53	0.48-13.40	0.276
80h-	2.40	0.45-12.80	0.306				2.62	0.42-16.34	0.304
Night duty									
None	1.00						1.00		
1-7/m	1.63	0.61-4.39	0.331				1.37	0.49-3.79	0.548
8-/m	1.82	0.57-5.76	0.310				1.54	0.45-5.22	0.491
Income satisfaction (dissatisfied vs. satisfied)	3.77	1.77-8.07	0.001	3.88	1.78-8.48	0.001	3.63	1.63-8.10	0.002
Opportunity for training or attending medical conference (dissatisfied vs. satisfied)	1.80	0.85-3.81	0.127	1.67	0.77-3.62	0.196	1.57	0.71-3.50	0.267
Work-life balance (dissatisfied vs. satisfied)	1.61	0.74-3.52	0.234	1.58	0.72-3.49	0.258	1.31	0.56-3.03	0.533
Job stress questionnaire									
Demand				0.98	0.84-1.15	0.789	0.94	0.79-1.11	0.454
Control				0.71	0.58-0.87	0.001	0.72	0.58-0.88	0.002
Supervisor support				0.95	0.80-1.14	0.594	0.93	0.78-1.12	0.444
Co-worker support				0.98	0.83-1.15	0.768	0.97	0.82-1.14	0.681

All 509 participants were analyzed in model I, II and III using multiple imputations.

sequences are increasing, medical technology is rapidly developing, and a lot of patient-related documents have to be submitted to the government and other agencies (Wada et al. 2008). Consequently, more job control may have an effective buffering effect. Interventional factors of job control in rural medicine should be elucidated in further studies.

Dissatisfaction with income was significantly related to intention to resign in our study. One study of hospital physicians in Taiwan reported that dissatisfaction with income had a significantly higher OR for intention to resign the current hospital, but the relation was not modified by working hours (Tsai et al. 2016). In the another study of Chinese village doctors, income satisfaction had a significantly lower OR for turn over intention in village doctors, but actual income level was not related (Fang et al. 2014). Thus, not the amount of income but income satisfaction is a possible factor to continue working since income satisfaction may be influenced by personal perception of income value compared with rural work burden.

Two other factors of the DCS model, demand and social support from co-workers, were significant related to burnout in our study. Systematic reviews have also shown that high job demand and low social support are risks for common mental disorders and burnout symptoms (Stansfeld and Candy 2006; Nieuwenhuijsen et al. 2010; Aronsson et al. 2017). In our previous study of physicians in Japan, support from co-workers was significantly associated with both depressive symptoms and burnout, but support from supervisors was not (Saijo et al. 2013). Furthermore, a review of factors affecting U.S. physicians' job satisfaction reported that job support from colleagues was consistently related to job satisfaction in five studies, but support from supervisors was not (Scheurer et al. 2009), and a review of general practitioners reported that relationships and contact

Table 6. Adjusted odds ratios for burnout.

	Model 1			Model 2			Model 3		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Male (vs. female)	0.49	0.21-1.17	0.106	0.57	0.22-1.48	0.245	0.56	0.21-1.50	0.248
Age									
-29y	1.80	0.23-14.32	0.580	3.15	0.34-29.20	0.313	2.97	0.33-26.82	0.333
30-39y	1.95	0.58-6.53	0.278	5.66	1.50-21.30	0.010	5.82	1.50-22.53	0.011
40-49y	1.65	0.55-4.99	0.375	2.54	0.75-8.60	0.133	2.96	0.85-10.35	0.090
50-59y	2.17	0.82-5.71	0.117	2.29	0.80-6.52	0.122	2.47	0.85-7.15	0.095
60-69y	2.28	0.90-5.81	0.083	2.50	0.89-6.98	0.081	2.58	0.91-7.29	0.074
70y-									
Married (vs. unmarried)	1.06	0.53-5.81	0.867	0.83	0.40-1.73	0.617	0.73	0.34-1.56	0.420
General (vs. specific)	1.54	0.64-3.70	0.335	1.40	0.56-3.49	0.471	1.49	0.59-3.78	0.403
Hometown									
The same town or village									
Other town or village in the same prefecture	1.09	0.54-2.20	0.804	0.83	0.38-1.80	0.632	0.93	0.42-2.05	0.856
A city in the same prefecture	0.62	0.31-1.23	0.171	0.52	0.24-1.10	0.088	0.50	0.23-1.09	0.079
A town or village in other prefectures	1.06	0.49-2.29	0.881	1.35	0.57-3.18	0.496	1.37	0.57-3.30	0.481
A city in other prefectures	0.65	0.33-1.31	0.227	0.86	0.41-1.81	0.689	0.80	0.37-1.73	0.568
Clinic (vs. hospital)	1.05	0.52-2.10	0.896	0.84	0.44-1.60	0.592	1.09	0.49-2.41	0.830
Lower position	1.04	0.47-2.32	0.922	0.77	0.31-1.95	0.585	0.75	0.29-1.91	0.545
Working hours (per week)									
-39h	1.00								
40-49h	0.89	0.38-2.04	0.775				0.63	0.24-1.63	0.341
50-59h	0.94	0.37-2.37	0.889				0.42	0.14-1.24	0.117
60-79h	1.26	0.48-3.30	0.637				0.45	0.14-1.43	0.176
80h-	1.89	0.65-5.56	0.245				0.62	0.18-2.18	0.457
Night duty									
None	1.00								
1-7/m	1.91	0.95-3.85	0.070				1.62	0.74-3.55	0.225
8-/m	2.04	0.89-4.66	0.092				2.35	0.93-5.92	0.070
Income satisfaction (dissatisfied vs. satisfied)	1.28	0.70-2.33	0.419	1.14	0.59-2.20	0.690	1.00	0.51-1.98	0.990
Opportunity for training or attending medical conferences (dissatisfied vs. satisfied)	1.91	1.17-3.10	0.009	1.30	0.77-2.20	0.330	1.40	0.81-2.42	0.226
Work-life balance (dissatisfied vs. satisfied)	3.58	2.04-6.28	< 0.001	2.97	1.61-5.45	< 0.001	2.77	1.48-5.19	0.001
Job stress questionnaire									
Demand				1.43	1.26-1.64	< 0.001	1.48	1.28-1.72	< 0.001
Control				0.65	0.55-0.77	< 0.001	0.66	0.55-0.78	< 0.001
Supervisor support				0.94	0.82-1.08	0.380	0.94	0.82-1.08	0.375
Co-worker support				0.88	0.78-0.99	0.033	0.88	0.78-1.00	0.044

All 509 participants were analyzed in model I, II and III using multiple imputations.

with colleagues contributed to job satisfaction (Van Ham et al. 2006). Thus, support from co-workers may be more consequential for physicians compared to support from supervisors. However, details of such support from co-workers were not obtained in the present study. In rural clinics, there are many clinics where there is only one physician, but paramedical staff as co-workers may have a buffering effect. Further studies are needed to clarify what types of support from co-workers is effective.

Work burden variables, working hours and night duty, were statistically significant in the crude analyses for both intention to resign and burnout, but significances disappeared in multivariate analyses. One reason for the negative results may be due to age factor in that the younger physicians have a higher work burden, and they also intend to change job more (Gauld and Horsburgh 2015) , as well as suffer from burnout (West et al. 2018). However, excessive workloads such as long work hours and being frequently on call have been reported as risks of intention to leave and burnout among physicians (Young and Leese 1999; West et al. 2018). Further studies on rural physicians with a larger sample size should be done to further elucidate these effects.

Of the participants, 10.4% answered they intended to resign their current hospital or clinic. One study of Japanese rural doctors reported that only 26% intended to continue a rural carrier (Matsumoto et al. 2005). Another study of Chinese village doctors reported that 36.8% intended to leave (Fang et al. 2014). In an Australian study of rural GPs, it was reported that 52.7% had seriously considered leaving rural general practice in the last two years (Gardiner et al. 2005). It is difficult to directly compare the prevalence of intention to leave between studies, since the methods used to measure an intention to resign, the study period, and rural definition were different. However, because the prevalence of intention to resign in

our study was not so high, participants in our study were possibly more highly motivated for a rural carrier.

This study had several limitations. First, since this study was cross-sectional, we were unable to infer cause-effect relationships. Secondly, the response rate was relatively low. There might have been a tendency not to participate among physicians with greater job stress and burdens, which may have attenuated the significance of the results. Also, we cannot present characteristics of the non-respondents because we only had hospital or clinic names and address data when we distributed the questionnaires. Therefore, we cannot present the characteristic differences between responders and non-responders. Thirdly, the participants were restricted to four regions in Japan. However, since these regions included the northern most and southern most regions in Japan, we believe our results can be generalized to Japanese rural medicine. Fourth, we used the four-response-choice questions to measure "intention to resign." As previously mentioned, the standard method to measure "intention to leave" has not yet been established. Fifth, according to the Survey of Physicians, Dentists and Pharmacists 2018 conducted by the Ministry of Health, Labour and Welfare, the male-female ratio of internal medicine physicians was 5:1. However, in our present study, female physicians only comprised 7.7% of the total number of participants, which may be because the participants in our study were restricted to full-time physicians and the proportion of part-timers was higher in female physicians than in males. Finally, because this study used a questionnaire that measured exposures and outcomes simultaneously, a common method bias may exist.

In conclusion, our study of Japanese rural physicians suggests that low job control is related to both intention to resign and to burnout, and the having a hometown that was in the same prefecture but not the same village or town as the present position and dissatisfaction with income were related to intention to resign, and high job demand and low support from co-workers was related to burnout. Improving job stress factors, especially job control, and consideration of physicians' town or village level hometown (not prefecture level) and a satisfactory income may be important factors to prevent rural physicians for quitting their current job suffering from burnout.

Acknowledgments

This work was supported by Japan Society for the Promotion of Science (JSPS) Grant-in-Aid for Scientific Research (C) (Grant Number 24590592).

Conflict of Interest

The authors declare no conflict of interest.

References

Aronsson, G., Theorell, T., Grape, T., Hammarstrom, A., Hogstedt, C., Marteinsdottir, I., Skoog, I., Traskman-Bendz, L. & Hall, C. (2017) A systematic review including meta-analysis of work environment and burnout symptoms. *BMC Public Health*, **17**, 264.

Balch, C.M. & Shanafelt, T. (2011) Combating stress and burnout in surgical practice: a review. *Thorac. Surg. Clin.*, **21**, 417-430.

Brenninkmeijer, V. & VanYperen, N. (2003) How to conduct research on burnout: advantages and disadvantages of a unidimensional approach in burnout research. *Occup. Environ. Med.*, **60 Suppl 1**, i16-20.

Degen, C., Weigl, M., Glaser, J., Li, J. & Angerer, P. (2014) The impact of training and working conditions on junior doctors' intention to leave clinical practice. *BMC Med. Educ.*, **14**, 119.

Enoki, M., Maeda, E., Iwata, T. & Murata, K. (2017) The Association between Work-Related Stress and Autonomic Imbalance among Call Center Employees in Japan. *Tohoku J. Exp. Med.*, **243**, 321-328.

Fang, P., Liu, X., Huang, L., Zhang, X. & Fang, Z. (2014) Factors that influence the turnover intention of Chinese village doctors based on the investigation results of Xiangyang City in Hubei Province. *Int. J. Equity Health*, **13**, 84.

Gardiner, M., Sexton, R., Durbridge, M. & Garrard, K. (2005) The role of psychological well-being in retaining rural general practitioners. *Aust. J. Rural Health*, **13**, 149-155.

Gauld, R. & Horsburgh, S. (2015) What motivates doctors to leave the UK NHS for a "life in the sun" in New Zealand; and, once there, why don't they stay? *Hum. Resour. Health*, **13**, 75.

Heponiemi, T., Kouvonen, A., Vanska, J., Halila, H., Sinervo, T., Kivimaki, M. & Elovainio, M. (2009) The association of distress and sleeping problems with physicians' intentions to change profession: the moderating effect of job control. *J. Occup. Health Psychol.*, **14**, 365-373.

Johnson, J.V., Hall, E.M. & Theorell, T. (1989) Combined effects of job strain and social isolation on cardiovascular disease morbidity and mortality in a random sample of the Swedish male working population. *Scand. J. Work. Environ. Health*, **15**, 271-279.

Karasek, R.A. (1979) Job demands, job decision latitude, and mental strain: implications for job redesign. *Adm. Sci. Q.*, **24**, 285-308.

Kitaoka-Higashiguchi, K., Morikawa, Y., Miura, K., Sakurai, M., Ishizaki, M., Kido, T., Naruse, Y. & Nakagawa, H. (2009) Burnout and risk factors for arteriosclerotic disease: follow-up study. *J. Occup. Health*, **51**, 123-131.

Kitaoka-Higashiguchi, K., Nakagawa, H., Morikawa, Y., Ishizaki, M., Miura, K., Naruse, Y., Kido, T. & Higashiyama, M. (2004a) Construct validity of the Maslach Burnout Inventory-General Survey. *Stress and Health*, **20**, 255-260.

Kitaoka-Higashiguchi, K., Ogino, K. & Masuda, S. (2004b) Validation of a Japanese research version of the Maslach Burnout Inventory-General Survey. *Jpn. J. Psychol.*, **75**, 415-419 (in Japanese).

Kroll, H.R., Macaulay, T. & Jesse, M. (2016) A Preliminary Survey Examining Predictors of Burnout in Pain Medicine Physicians in the United States. *Pain Physician*, **19**, E689-696.

Kuusio, H., Heponiemi, T., Vanska, J., Aalto, A.M., Ruskoaho, J. & Elovainio, M. (2013) Psychosocial stress factors and intention to leave job: differences between foreign-born and Finnish-born general practitioners. *Scand. J. Public Health*, **41**, 405-411.

Magnus, J.H. & Tollan, A. (1993) Rural doctor recruitment: does medical education in rural districts recruit doctors to rural areas? *Med. Educ.*, **27**, 250-253.

Maslach, C. & Jackson, S.E. (1981) The measurement of experienced burnout. *J. Org. Behav.*, **2**, 99-113.

Maslach, C.M., Jackson, S.E., Leiter, M.P., Schaufeli, W.B. & Schwab, R.L. (2016) *The Maslach Burnout Inventory Manual*, 4th ed., Mind Garden, Menlo Park, CA.

Maslach, C., Schaufeli, W.B. & Leiter, M.P. (2001) Job burnout. *Annu. Rev. Psychol.*, **52**, 397-422.

Matsumoto, M., Okayama, M., Inoue, K. & Kajii, E. (2005) Factors associated with rural doctors' intention to continue a rural career: a survey of 3072 doctors in Japan. *Aust. J. Rural Health*, **13**, 219-225.

Matsumoto, M., Takeuchi, K., Tanaka, J., Tazuma, S., Inoue, K., Owaki, T., Iguchi, S. & Maeda, T. (2016) Follow-up study of the regional quota system of Japanese medical schools and prefecture scholarship programmes: a study protocol. *BMJ Open*, **6**, e011165.

Nieuwenhuijsen, K., Bruinvels, D. & Frings-Dresen, M. (2010) Psychosocial work environment and stress-related disorders, a systematic review. *Occup. Med.* (*Lond.*), **60**, 277-286.

Otsuka, T., Kawada, T., Ibuki, C. & Kusama, Y. (2009) Relationship between job strain and radial arterial wave reflection in middle-aged male workers. *Prev. Med.*, **49**, 260-264.

Prins, J.T., van der Heijden, F.M., Hoekstra-Weebers, J.E., Bakker, A.B., van de Wiel, H.B., Jacobs, B. & Gazendam-Donofrio, S.M. (2009) Burnout, engagement and resident physicians' self-reported errors. *Psychol. Health Med.*, **14**, 654-666.

Saijo, Y., Chiba, S., Yoshioka, E., Kawanishi, Y., Nakagi, Y., Ito, T., Sugioka, Y., Kitaoka-Higashiguchi, K. & Yoshida, T. (2013) Job stress and burnout among urban and rural hospital physicians in Japan. *Aust. J. Rural Health*, **21**, 225-231.

Saijo, Y., Chiba, S., Yoshioka, E., Kawanishi, Y., Nakagi, Y., Itoh, T., Sugioka, Y., Kitaoka-Higashiguchi, K. & Yoshida, T. (2014) Effects of work burden, job strain and support on depressive symptoms and burnout among Japanese physicians. *Int. J. Occup. Med. Environ. Health*, **27**, 980-992.

Saijo, Y., Yoshioka, E., Kawanishi, Y., Nakagi, Y., Hanley, S.J.B. & Yoshida, T. (2018) Relationships between road-distance to primary care facilities and ischemic heart disease and stroke mortality in Hokkaido, Japan: a Bayesian hierarchical approach to ecological count data. *J. Gen. Fam. Med.*, **19**, 4-8.

Saijo, Y., Yoshioka, E., Kawanishi, Y., Nakagi, Y., Itoh, T. & Yoshida, T. (2016) Relationships of job demand, job control, and social support on intention to leave and depressive symptoms in Japanese nurses. *Ind. Health*, **54**, 32-41.

Schaufeli, W.B., Leiter, M.P. & Maslach, C. (2009) Burnout: 35 years of research and practice. *Career Development International*, **14**, 204-220.

Scheurer, D., McKean, S., Miller, J. & Wetterneck, T. (2009) U.S. physician satisfaction: a systematic review. *J. Hosp. Med.*, **4**, 560-568.

Shanafelt, T.D., Boone, S., Tan, L., Dyrbye, L.N., Sotile, W., Satele, D., West, C.P., Sloan, J. & Oreskovich, M.R. (2012) Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch. Intern. Med.*, **172**, 1377-1385.

Shimomitsu, T., Haratani, T., Ohno, H., Nakamura, K., Kawakami, N., Hayashi, T., Hiro, H., Arai, M., Miyazaki, S., Furuki, K., Ohya, Y. & Odagiri, Y. (2000) Final development of the Brief Job Stress Questionnaire mainly used for assessment of the individuals. In: *The Ministry of Labor sponsored grant for the prevention of work-related illness*, edited by Kato, M., Tokyo Medical College, Tokyo.

Soler, J.K., Yaman, H., Esteva, M., Dobbs, F., Asenova, R.S., Katic, M., Ozvacic, Z., Desgranges, J.P., Moreau, A., Lionis, C., Kotanyi, P., Carelli, F., Nowak, P.R., de Aguiar Sa Azeredo, Z., Marklund, E., et al. (2008) Burnout in European family doctors: the EGPRN study. *Fam. Pract.*, **25**, 245-265.

Stansfeld, S. & Candy, B. (2006) Psychosocial work environment and mental health: a meta-analytic review. *Scand. J. Work. Environ. Health*, **32**, 443-462.

Suwazono, Y., Dochi, M., Kobayashi, E., Oishi, M., Okubo, Y., Tanaka, K. & Sakata, K. (2008) Benchmark duration of work hours for development of fatigue symptoms in Japanese workers with adjustment for job-related stress. *Risk Anal.*, **28**, 1689-1698.

Tanihara, S., Kobayashi, Y., Une, H. & Kawachi, I. (2011) Urbanization and physician maldistribution: a longitudinal study in Japan. *BMC Health Serv. Res.*, **11**, 260.

Tsai, Y.H., Huang, N., Chien, L.Y., Chiang, J.H. & Chiou, S.T. (2016) Work hours and turnover intention among hospital physicians in Taiwan: does income matter? *BMC Health Serv. Res.*, **16**, 667.

Van Ham, I., Verhoeven, A.A., Groenier, K.H., Groothoff, J.W. & De Haan, J. (2006) Job satisfaction among general practitioners: a systematic literature review. *Eur. J. Gen. Pract.*, **12**, 174-180.

Wada, K., Arimatsu, M., Yoshikawa, T., Oda, S., Taniguchi, H., Higashi, T. & Aizawa, Y. (2008) Factors on working conditions and prolonged fatigue among physicians in Japan. *Int. Arch. Occup. Environ. Health*, **82**, 59-66.

Wang, Z., Xie, Z., Dai, J., Zhang, L., Huang, Y. & Chen, B. (2014) Physician burnout and its associated factors: a cross-sectional study in Shanghai. *J. Occup. Health*, **56**, 73-83.

West, C.P., Dyrbye, L.N. & Shanafelt, T.D. (2018) Physician Burnout: Contributors, Consequences, and Solutions. *J. Intern. Med.*, **283**, 516-529.

Young, R. & Leese, B. (1999) Recruitment and retention of general practitioners in the UK: what are the problems and solutions? *Br. J. Gen. Pract.*, **49**, 829-833.