

Acta Med. Okayama, 2014  
Vol. 68, No. 6, pp. 331–337

Copyright©2014 by Okayama University Medical School.

Acta Medica  
Okayama

<http://escholarship.lib.okayama-u.ac.jp/amo/>

Original Article

## Mental Health Status among Japanese Medical Students: A Cross-Sectional Survey of 20 Universities

Tadahiro Ohtsu<sup>a\*</sup>, Yoshitaka Kaneita<sup>b</sup>, Yoneatsu Osaki<sup>c</sup>, Akatsuki Kokaze<sup>a</sup>,  
Hirota Ochiai<sup>a</sup>, Takako Shirasawa<sup>a</sup>, Hinako Nanri<sup>a</sup>, and Takashi Ohida<sup>d</sup>

<sup>a</sup>Department of Public Health, Showa University School of Medicine, Tokyo 142-8555, Japan,

<sup>b</sup>Department of Public Health and Epidemiology, Faculty of Medicine, Oita University, Yufu, Oita 879-5593, Japan,

<sup>c</sup>Division of Environmental and Preventive Medicine, Department of Social Medicine, Faculty of Medicine, Tottori University, Yonago, Tottori 683-8503, Japan, and <sup>d</sup>Department of Public Health, Nihon University School of Medicine, Tokyo 173-8610, Japan

The purposes of this study were to evaluate the mental health status of Japanese medical students and to examine differences based on gender, as well as on university type and location, using the results of a nationwide survey. Between December 2006 and March 2007, we conducted a questionnaire survey among fourth-year medical students at 20 randomly selected medical schools in Japan. The data from 1,619 students (response rate: 90.6%; male: 1,074; female: 545) were analyzed. We used the Japanese version of the 12-item General Health Questionnaire (GHQ-12) to measure mental health status. Poor mental health status (GHQ-12 score of 4 points or higher) was observed in 36.6% and 48.8% of the male and female medical students, respectively. The ratio of the age-adjusted prevalence of poor mental health status in female versus male medical students was 1.33 (95% confidence interval: 1.10–1.62). The universities were categorized into two groups based on the university type (national/public: 15 vs. private: 5) or location (in a large city: 7 vs. in a local city: 13 cities). The prevalence of poor mental health status in both men and women differed between these groups, although not significantly. The GHQ-12 scores in men significantly differed between the categorized groups of universities. These results suggest that adequate attention must be paid to the mental health of medical students, especially females, and that a system for providing mental health care for medical students must be established in the context of actual conditions at each university.

**Key words:** medical students, mental health, 12-item General Health Questionnaire, gender difference, Japan

In Japan, there are 51 national/public and 29 private university medical schools. In the 2003 fiscal year, the admission quota was 4,815 for national/public university medical schools and 2,880 for private university medical schools (7,695 in total) [1]. The standard Japanese undergraduate medical

education program is 6 years long, consisting typically of 4 years of preclinical education followed by 2 years of clinical education [2]. Medical schools are responsible for ensuring that graduates are knowledgeable, skillful, and professional [3]. Training highly capable medical doctors is a socially important task for medical schools in Japan, as well as overseas, from the viewpoint of maintaining and improving the level of health care.

Mosley *et al.* have reported that medical school is recognized as a stressful environment that often exerts

Received December 5, 2013; accepted August 20, 2014.

\*Corresponding author. Phone: +81-3-3784-8134; Fax: +81-3-3784-7733

<sup>†</sup>This study was conducted at this institution.

E-mail: tohtsu@med.showa-u.ac.jp (T. Ohtsu)

a negative effect on students' academic performance, physical health, and psychological well-being [4]. A study conducted in the UK indicated that approximately half of the surveyed students described a major stressful incident related to medical training [5]. In addition, Dyrbye *et al.* systematically reviewed the literature on depression, anxiety, and burnout among US and Canadian medical students published between January 1980 and May 2005 [6]. Based on the 40 articles obtained in this systematic review, the authors suggested that there is a high prevalence of depression and anxiety among medical students, with levels of overall psychological distress consistently higher than in the general population. In addition, according to a large-scale survey of 7,357 medical students in South Korea in 2006, the current, one-year, and lifetime prevalences of major depressive disorder were 2.9%, 6.5%, and 10.3%, respectively [7]. On the basis of these overseas findings, it is assumed that university faculty members will be required to support medical students as much as possible so that students can maintain good mental health and thereby maximize their learning potential in school. The mental health status of Japanese medical students is unclear because few studies have been conducted on this issue [8–12]. Among such studies, only 2 covered medical students from multiple universities: one covered 6 universities [9] and the other covered 2 [11].

Therefore, using data from a nationwide questionnaire survey, we aimed to (1) evaluate the mental health of Japanese medical students based on gender and age (basic attributes), and (2) examine differences in the prevalence of poor mental health status based on university type and location, taking advantage of the large-scale nature of the dataset, which covered medical students from 20 universities throughout the country.

## Materials and Methods

**Subjects.** In the present study, we analyzed data obtained from an anonymous, self-administered questionnaire survey on medical students' smoking status and associated factors [13]. This survey was completed by 1,900 fourth-year students (male: 1,287, female: 613) enrolled at 20 universities that were randomly selected from among the 80 universities [1]

in Japan that have medical schools. The survey was conducted between December 2006 and March 2007.

The purpose and outline of the study were explained to the participating medical students, and it was made clear that participation was voluntary. The privacy protection policy for personal and enrollment data was clearly stated in the questionnaire. Approval from the Ethics Committee of the National Institute of Public Health was obtained before the study was begun.

**12-item General Health Questionnaire (GHQ-12) and definition of poor mental health status.** For the measurement of mental health status, we used the Japanese version of the GHQ-12. The GHQ for screening mental disorders was developed by Goldberg in the UK in 1972 and was introduced in Japan in 1985 [14]. The simplest version of the GHQ is the 12-item version, which is frequently used in Japan as well as internationally because it requires less effort on the part of the respondents. The validity and reliability of the Japanese version have been confirmed [15–18].

GHQ-12 scores were calculated using the GHQ scoring system, in which the 4 options for each question are assigned scores of 0, 0, 1, and 1, and the total score was calculated [19]. Subjects scoring 4 points or higher were considered to have poor mental health status [5, 17, 18, 20].

**Statistical analysis.** In our statistical analysis, the gender- and age-based mean values of the GHQ-12 scores and the prevalence of poor mental status were first calculated. To examine the presence or absence of significant differences, the Mann-Whitney U test or Kruskal-Wallis test was used to assess the GHQ-12 scores, and the  $\chi^2$  test was used to assess the prevalence of poor mental status.

Second, to compare the prevalence of poor mental health status between the categorized groups of universities based on gender, the prevalence ratio in private universities relative to national/public universities was calculated, as was the 95% confidence interval (95% CI). To compare the GHQ-12 scores between groups, the Mann-Whitney U test was used. In the same manner, the universities located in large cities (Tokyo Metropolitan area and government-designated cities) and those located in local (smaller) cities were compared.

Third, all the universities were categorized into 4 groups according to university type (national/public or

private) and location (in large or local cities). Then, the gender-based prevalence of poor mental status was compared among the 4 groups; the group whose prevalence was expected to be the lowest based on the results of Step 2 (above) was used as the reference for calculating the prevalence ratios for the other 3 groups. The 95% CIs were also calculated. In addition, the Mann-Whitney U test was used to compare the GHQ-12 scores based on gender between the reference group and the group with the highest prevalence ratio.

The significance level was set at 5%. IBM SPSS Statistics 20 and Epi Info Version 3.5.3 were used for statistical analyses.

## Results

This questionnaire survey was conducted at 15 national/public universities and 5 private universities. Seven universities were located in large cities, and the other 13 universities were located in local cities. The questionnaires were distributed to 1,787 medical students (distribution percentage: 94.1%), of whom 1,683 returned responses (collection rate: 94.2%). We excluded questionnaires that were blank or where the gender and/or age of the respondents were not specified, thus yielding data for 1,619 participants (male: 1,074 [66.3%]; female: 545 [33.7%]) (response rate: 90.6%). With regard to the age distribution of the participants, 81.9% of males were

21–24 years old, 14.3% were 25–29 years old, and 3.7% were 30 years old or older. For females, 88.8% were 21–24 years old, 8.4% were 25–29 years old, and 2.8% were 30 years old or older. There was a significant gender difference in the age distribution ( $\chi^2$  test,  $p = 0.001$ ).

Table 1 shows the gender- and age-based mean (SD) scores for the GHQ-12 and the prevalence of poor mental health status. The mean (SD) GHQ-12 scores for male and female participants were 3.00 (2.94) and 3.82 (3.10), respectively, and the prevalences of poor mental status in men and women were 36.6% (95% CI: 33.7–39.5%) and 48.8% (95% CI: 44.6–53.0%), respectively. Significant gender differences were observed for both GHQ-12 scores and the prevalence of poor mental health status. There were no age-based differences in GHQ-12 scores or the prevalence of poor mental health status for either male or female participants. However, since a significant gender difference was observed in age distribution, the ratio of the age-adjusted prevalence of poor mental health status in women relative to men was calculated using Mantel-Haenszel stratified analysis, and the result was 1.33 (95% CI: 1.10–1.62). Cronbach's  $\alpha$  for the GHQ-12 items was 0.848 for men and 0.837 for women.

Table 2 shows the GHQ-12 scores and the prevalence of poor mental status by university type or location. For men, the mean (SD) GHQ-12 scores were 3.18 (2.90) for universities in large cities and

**Table 1** The gender- and age-based 12-item General Health Questionnaire (GHQ-12) scores and prevalence of poor mental health status<sup>a</sup>

Age	N <sup>b</sup>	GHQ-12 scores			Prevalence of poor mental status <sup>a</sup> (%)	
		Mean	SD	$p$ value	(95% CI)	$p$ value <sup>c</sup>
<b>Male</b>						
21–24	873	2.97	2.91	0.827 <sup>d</sup>	36.1 (32.9–39.3)	0.742
25–29	150	3.20	3.10		39.3 (31.5–47.2)	
30–yr	40	3.00	2.92		37.5 (22.5–52.5)	
Total	1,063	3.00	2.94	<0.001 <sup>e</sup>	36.6 (33.7–39.5)	<0.001
<b>Female</b>						
21–24	477	3.83	3.10	0.528 <sup>d</sup>	49.7 (45.2–54.2)	0.269
25–29	46	3.98	3.19		45.7 (31.3–60.0)	
30–yr	14	3.00	3.09		28.6 (4.9–52.2)	
Total	537	3.82	3.10		48.8 (44.6–53.0)	

<sup>a</sup>GHQ-12 score of 4 points or higher; <sup>b</sup>The missing data have been excluded from the statistical analyses; <sup>c</sup> $\chi^2$  test; <sup>d</sup>Kruskal-Wallis test; <sup>e</sup>Mann-Whitney U test; CI, confidence interval.

2.89 (2.96) for universities in local cities; this difference was significant. The ratio of the prevalence of poor mental status in private universities relative to national/public universities was greater than 1, and the prevalence ratio for local cities relative to large cities was less than 1; neither difference was significant. In contrast, for women, no significant difference was observed in the GHQ-12 scores, and both of the above-mentioned ratios were almost 1 (0.99 and 0.98, respectively).

Table 3 shows the GHQ-12 scores and prevalence of poor mental status by university type and location. For men, the prevalence among students at national/public universities in large cities and that at private universities in local cities relative to national/public universities in local cities were both approximately 1. However, the prevalence ratio among students at private universities in large cities relative to national/public universities in local cities was greater than 1 (1.23 [95% CI: 0.90-1.70]), and the mean GHQ-12

**Table 2** The 12-item General Health Questionnaire (GHQ-12) scores and prevalence of poor mental health status<sup>a</sup> by gender and by university type and location

Universities	N <sup>b</sup>	GHQ-12 scores			Poor mental status		
		Mean	SD	<i>p</i> value <sup>c</sup>	Pr <sup>a</sup> (%)	Ratio	95% CI
<b>Male</b>							
National/public <sup>d</sup>	763	2.93	2.95	] 0.071	35.3	1.00	reference
Private <sup>d</sup>	300	3.21	2.90		40.0	1.13	0.87-1.47
Large cities <sup>e</sup>	414	3.18	2.90	] 0.035	39.1	1.00	reference
Local cities <sup>e</sup>	649	2.89	2.96		35.0	0.89	0.70-1.14
<b>Female</b>							
National/public <sup>d</sup>	384	3.78	3.06	] 0.747	49.0	1.00	reference
Privated	153	3.92	3.22		48.4	0.99	0.70-1.39
Large cities <sup>e</sup>	168	3.78	3.13	] 0.850	49.4	1.00	reference
Local cities <sup>e</sup>	369	3.84	3.10		48.5	0.98	0.71-1.37

<sup>a</sup>GHQ-12 score of 4 points or higher; <sup>b</sup>The missing data have been excluded from the statistical analyses; <sup>c</sup>Mann-Whitney U test; <sup>d</sup>15 national/public universities and 5 private universities; <sup>e</sup>Seven universities were located in large cities (Tokyo Metropolitan area and government-designated cities), and the other 13 universities were located in local cities; CI, confidence interval.

**Table 3** The 12-item General Health Questionnaire (GHQ-12) scores and prevalence of poor mental health status<sup>a</sup> by gender when the universities were categorized into 4 groups

Universities	Location	N <sup>b</sup>	GHQ-12 scores			Poor mental status		
			Mean	SD	<i>p</i> value <sup>c</sup>	Pr <sup>a</sup> (%)	Ratio	95% CI
<b>Male</b>								
National/public	Large cities <sup>d</sup>	227	2.92	2.82	] 0.006	35.7	1.02	0.74-1.39
	Local cities <sup>e</sup>	536	2.93	3.01		35.1	1.00	reference
Private	Large cities <sup>f</sup>	187	3.49	2.99		43.3	1.23	0.90-1.70
	Local cities <sup>g</sup>	113	2.73	2.71		34.5	0.98	0.65-1.49
<b>Female</b>								
National/public	Large cities <sup>d</sup>	82	3.37	2.81	] 0.337	46.3	1.07	0.58-2.00
	Local cities <sup>e</sup>	302	3.89	3.12		49.7	1.15	0.69-1.90
Private	Large cities <sup>f</sup>	86	4.17	3.37		52.3	1.21	0.66-2.21
	Local cities <sup>g</sup>	67	3.58	3.01		43.3	1.00	reference

<sup>a</sup>GHQ-12 score of 4 points or higher; <sup>b</sup>The missing data have been excluded from the statistical analyses; <sup>c</sup>Mann-Whitney U test; Number of universities: <sup>d</sup>4, <sup>e</sup>11, <sup>f</sup>3, <sup>g</sup>2; CI, confidence interval.

scores significantly differed between these groups (3.49 for private universities in large cities and 2.93 for national/public universities in local cities). Similar results were obtained for women; the prevalence of poor mental status was highest among students at private universities in large cities (52.3%), and the ratio of this prevalence to that for private universities in local cities was greater than 1 (1.21 [95% CI: 0.66-2.21]). No significant difference was observed in the GHQ-12 scores between these groups.

### Discussion

The data analyzed in this study were representative of Japanese medical students for the following reasons: The response rate for the questionnaire survey was high (approximately 90%); 20 university medical schools, comprising one-fourth of all university medical schools in Japan [1], were randomly sampled; the gender composition of the data used in this study was similar to that for the 25,996 physicians in Japan aged 29 years or less at the end of 2006 (males: 64.2%, females: 35.8%) [21]. These comparisons suggest that the samples used in this study are representative of recently enrolled medical students in Japan.

Another feature of this study was the large sample size. The GHQ-12 has been used in studies of mental health in medical students in the UK [5, 22-25], Turkey [26], Malaysia [20, 27-30], Nigeria [31, 32], Iraq [33], Japan [11], Iran [34], and Serbia [35]. Of the 14 cross-sectional studies that remain after excluding 3 cohort studies [23, 24, 26], the study with the largest number of participants (847) was conducted in Nigeria [31]. The sample size of the present cross-sectional study was almost twice that of the Nigerian study. Therefore, we believe that our results are highly significant and will provide reference values for the mental health of medical students in Japan.

In this study, we observed significant gender differences in GHQ-12 scores and in the prevalence of poor mental health status among Japanese medical students. The female-to-male ratio of the age-adjusted prevalence of poor mental health status was significant and high. Previous studies in the UK [5, 22-25], Malaysia [27, 28], and Nigeria [31] found no gender differences. In contrast, previous studies in Iraq

[33], Iran [34], and Serbia [35] found that GHQ-12 scores were significantly higher for women than for men, which is consistent with the present study. In particular, the Iraq study found that the prevalences of poor mental health status in men and women were 33.3% and 47.0%, respectively [33]. In addition, the Iran study [36], which used the GHQ-28, indicated that the prevalences of poor mental health status in men and women were 36.7% and 45.7%, respectively. It is interesting that the results of those studies were very similar to those obtained in the present one. In a review of studies on US and Canadian medical students, Dyrbye *et al.* stated that comparisons of depressive symptoms by gender yielded mixed findings [6]. The results of the present study suggest that special attention must be paid to the mental health of female medical students in Japan because approximately half (48.8%) of the female participants had poor mental status.

In a study of the general population in Japan, the mean  $\pm$  SD GHQ-12 scores for male and female subjects aged 20-29 years were  $2.77 \pm 2.86$  ( $N = 102$ ) and  $3.88 \pm 3.16$  ( $N = 120$ ), respectively [16]. In comparison to these results, the result for men in the present study ( $3.00 \pm 2.94$ ) was slightly higher, and that for women ( $3.82 \pm 3.10$ ) was almost the same. This finding suggests that male Japanese medical students tend to have rather poorer mental health than men in the Japanese general population. However, a study conducted in the UK reported a large difference in the percentages of people having GHQ-12 score of 4 or more between medical students (31%,  $N = 318$ ) and young employed people (8.5%,  $N = 222$ ) [22]. In addition, the GHQ-12 scores among young women in Japan may be generally high.

As mentioned previously, since a large number (20) of universities participated in this study, it was possible to compare GHQ-12 scores and the prevalence of poor mental status based on university type (national/public or private) and/or location (in large or local cities) (Tables 2 and 3). When the universities were categorized into 4 groups, the prevalence of poor mental status was highest at private universities in large cities; the difference between the minimum and maximum values was slightly less than 10 points for both men and women. The prevalence ratio for the highest group relative to the reference group was 1.23 for men and 1.21 for women. In men, the GHQ-12

scores significantly differed with regard to university location (Table 2) and in the comparison of the 4 groups (Table 3).

A survey conducted on female medical students at a private women's medical school in Tokyo using the GHQ-30 reported that 51.7% of students scored the cutoff value or higher for poor mental health status [10], which is similar to the result (52.3%) obtained in this study (Table 3). In addition, a survey conducted at 2 national/public universities in Japan indicated that students' well-being and mental health were better at the university providing more mental health-care systems than the university providing fewer systems [11]. Combined with the results of our study, this suggests that universities should assess the actual mental health status of medical students, and establish support systems in line with those conditions.

The limitations of this study and the issues to be addressed in future studies are as follows. First, since all participants were fourth-year medical students, comparisons with medical students in other years could not be performed. For fourth-year students, the period when the survey was conducted is a preparation period for clinical training that begins in the fifth year [2]. Mental status may be even poorer among second-year medical students, who are beginning to study specialized subjects, and among sixth-year medical students, who are required to take graduation examinations and a national examination for medical practitioners [2]. Therefore, studies surveying medical students from all 6 academic years [30] or prospective longitudinal studies [23] that document changes in mental health status within the same population as they advance are required. Second, when the participating universities were categorized into 4 groups, the number of private universities became especially small (3 in large cities and 2 in local cities). These may not necessarily be representative samples in each category. To clarify the differences between universities of different types and in different locations, a survey covering all university medical schools, such as the one conducted in South Korea [7], would be preferable. Third, as this study did not examine the factors that may affect the mental health of medical students, the causes of the differences based on gender and those based on university type and location are unknown. Vitaliano *et al.* showed that medical students experienced academic, social and personal,

and financial pressures [37]. It will be important to clarify which specific types of pressure affect the mental well-being of medical students, and to what degree. On the basis of that clarification, medical schools will need to develop and evaluate programs that support struggling students and promote students' psychological well-being [3].

This study measured and evaluated the mental health of Japanese medical students using the GHQ-12 questionnaire. The prevalences of poor mental health status in male and female medical students were 36.6% and 48.8%, respectively, and there was a significant gender difference. When the universities were categorized by type (national/public or private) and location (in large or local cities), differences were observed in the prevalence of poor mental status, but they were not significant. The GHQ-12 scores significantly differed between categorized groups of universities in male medical students. These results suggest that attention must be devoted to the mental health of female medical students, and that a system for providing mental health care for medical students must be established based on the actual conditions at each university.

**Acknowledgments.** The present study was part of the "Fact-finding survey on smoking among juveniles" (Chief researcher: Dr. Kenji Hayashi), performed by the National Institute of Public Health. This research project was supported by a Health Science Research Grant from the Ministry of Health, Labour and Welfare of the Japanese Government in 2006 (*H18-Junkankitou-Ippan-004*). Creation of this manuscript was subsidized by JSPS *KAKENHI* Grant Number 24650537.

We are grateful to the staff members of the participating universities for their cooperation with our research, and to all of the medical students who answered the questionnaire. We would also like to thank Ms. Hiromi Ogo and Ms. Hiromi Hoshino for their help with this study.

## References

1. Health, Labour and Welfare Statistics Association: Trends in national hygiene, trends in health and medical care, medical measures, healthcare professional. *Journal of Health and Welfare Statistics Extra* (2012) 59: 191-205 (in Japanese).
2. Kozu T: Medical education in Japan. *Acad Med* (2006) 81: 1069-1075.
3. Dyrbye LN, Thomas MR and Shanafelt TD: Medical student distress: causes, consequences, and proposed solutions. *Mayo Clin Proc* (2005) 80: 1613-1622.
4. Mosley TH Jr, Perrin SG, Neral SM, Dubbert PM, Grothues CA and Pinto BM: Stress, coping, and well-being among third-year medical students. *Acad Med* (1994) 69: 765-767.
5. Guthrie EA, Black D, Shaw CM, Hamilton J, Creed FH and Tomenson B: Embarking upon a medical career: psychological

- morbidity in first year medical students. *Med Educ* (1995) 29: 337–341.
6. Dyrbye LN, Thomas MR and Shanafelt TD: Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. *Acad Med* (2006) 81: 354–373.
  7. Roh MS, Jeon HJ, Kim H, Han SK and Hahm BJ: The prevalence and impact of depression among medical students: a nationwide cross-sectional study in South Korea. *Acad Med* (2010) 85: 1384–1390.
  8. Mino Y, Yasuda N, Fujimura T and Ohara H: Caffeine consumption and anxiety and depressive symptomatology among medical students. *Jpn J Alcohol & Drug Dependence* (1990) 25: 486–496.
  9. Nagata-Kobayashi S, Sekimoto M, Koyama H, Yamamoto W, Goto E, Fukushima O, Ino T, Shimada T, Shimbo T, Asai A, Koizumi S and Fukui T: Medical student abuse during clinical clerkships in Japan. *J Gen Intern Med* (2006) 21: 212–218.
  10. Higaki Y, Watanabe I and Kamo T: Mental health problems and quality of life of female medical students in Japan. *Tokyo Joshi Ikadaigaku Zasshi* (2009) 79: 360–366 (in Japanese).
  11. Sasamoto M, Kudo Y, Osakabe Y, Kasahara S and Niwa S: Do well-developed mental health care systems actually improve mental health status of students in schools of medicine and health sciences? *Rinsyou Seishin Igaku* (2010) 39: 471–478 (in Japanese).
  12. Ogasawara H, Tanaka G, Horiguchi M and Kawaguchi A: Depressive states associated with risk factors for lifestyle-related diseases in medical students: association with insulin resistance and blood pressure. *The Japanese Journal of Health Psychology* (2011) 24: 42–49 (in Japanese).
  13. Tamaki T, Kaneita Y, Ohida T, Yokoyama E, Osaki Y, Kanda H, Takemura S and Hayashi K: Prevalence of and factors associated with smoking among Japanese medical students. *J Epidemiol* (2010) 20: 339–345.
  14. Fukunishi I: The assessment of cut-off point of the General Health Questionnaire (GHQ) in the Japanese version. *Shinri Rinsyou* (1990) 3: 228–234 (in Japanese).
  15. Iwata N, Okuyama Y, Kawakami Y and Saito K: The twelve-item General Health Questionnaire among Japanese workers. *Environ Sci Hokkaido Univ* (1988) 11: 1–10.
  16. Doi Y and Minowa M: Factor structure of the 12-item General Health Questionnaire in the Japanese general adult population. *Psychiatry Clin Neurosci* (2003) 57: 379–383.
  17. Shimbo M, Nakamura K, Jing Shi H, Kizuki M, Seino K, Inose T and Takano T: Green tea consumption in everyday life and mental health. *Public Health Nutr* (2005) 8: 1300–1306.
  18. Kaneita Y, Ohida T, Osaki Y, Tanihata T, Minowa M, Suzuki K, Wada K, Kanda H and Hayashi K: Association between mental health status and sleep status among adolescents in Japan: a nationwide cross-sectional survey. *J Clin Psychiatry* (2007) 68: 1426–1435.
  19. Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O and Rutter C: The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* (1997) 27: 191–197.
  20. Yusoff MSB: Impact of summative assessment on first year medical students' mental health. *Int Med J* (2011) 18: 172–175.
  21. Ministry of Health, Labour and Welfare: Summary of the survey on physicians, dentists, and pharmacists in 2006. (2007) (in Japanese).
  22. Firth J: Levels and sources of stress in medical students. *Br Med J (Clin Res Ed)* (1986) 292: 1177–1180.
  23. Guthrie E, Black D, Bagalkote H, Shaw C, Campbell M and Creed F: Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *J R Soc Med* (1998) 91: 237–243.
  24. Moffat KJ, McConnachie A, Ross S and Morrison JM: First year medical student stress and coping in a problem-based learning medical curriculum. *Med Educ* (2004) 38: 482–491.
  25. Ross S, Cleland J and Macleod MJ: Stress, debt and undergraduate medical student performance. *Med Educ* (2006) 40: 584–589.
  26. Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H and Akaydin M: Anxiety, depression and stressful life events among medical students: a prospective study in Antalya, Turkey. *Med Educ* (2001) 35: 12–17.
  27. Sherina MS, Lekhraj R and Nadarajan K: Prevalence of emotional disorders among medical students in a Malaysian university. *Asia Pac Fam Med* (2003) 2: 213–217.
  28. Zaid ZA, Chan SC and Ho JJ: Emotional disorders among medical students in a Malaysian private medical school. *Singapore Med J* (2007) 48: 895–899.
  29. Zailinawati AH, Teng CL, Chung YC, Teow TL, Lee PN and Jagmohni KS: Daytime sleepiness and sleep quality among Malaysian medical students. *Med J Malaysia* (2009) 64: 108–110.
  30. Yusoff MS, Abdul Rahim AF and Yaacob MJ: Prevalence and sources of stress among Universiti Sains Malaysia medical students. *Malays J Med Sci* (2010) 17: 30–37.
  31. Omigbodun OO, Odukoogbe AT, Omigbodun AO, Yusuf OB, Bella TT and Olayemi O: Stressors and psychological symptoms in students of medicine and allied health professions in Nigeria. *Soc Psychiatry Psychiatr Epidemiol* (2006) 41: 415–421.
  32. Issa BA, Yussuf AD, Olatinwo AW and Ighodalo M: Premenstrual dysphoric disorder among medical students of a Nigerian university. *Ann Afr Med* (2010) 9: 118–122.
  33. Al-Nimer MS: Measuring mental health following the 6-year American invasion of Iraq. A general health questionnaire analysis of Iraqi medical and dentistry students. *Neurosciences (Riyadh)* (2010) 15: 27–32.
  34. Jafari N, Loghmani A and Montazeri A: Mental health of medical students in different levels of training. *Int J Prev Med* (2012) 3: S107–S112.
  35. Backović DV, Zivojinović JI, Maksimović J and Maksimović M: Gender differences in academic stress and burnout among medical students in final years of education. *Psychiatr Danub* (2012) 24: 175–181.
  36. Shariati M, Yunesian M and Vash JH: Mental health of medical students: a cross-sectional study in Tehran. *Psychol Rep* (2007) 100: 346–354.
  37. Vitaliano PP, Russo J, Carr JE and Heerwagen JH: Medical school pressures and their relationship to anxiety. *J Nerv Ment Dis* (1984) 172: 730–736.