Prevalence of depression and its correlation with anxiety, headache and sleep disorders amongst medical staff in South China

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Abstract

Background: Our previous studies reported the prevalence of primary headache and risk factors among medical staff in South China. The aim of this cross-sectional survey was to learn more about the prevalence of depression in medical staff and its risk factors, as well as to investigate the association between depression, anxiety, headache, and sleep disorders.

Methods: Stratified random cluster sampling was used to select medical staff from various departments in four hospitals in Sanya City. Based on previously study, the Self-rating Depression Scale（SDS）, Self-rating Anxiety Scale (SAS), Pittsburgh Sleep Quality Index (PSQI) were used to quantitatively score the depression, anxiety and sleep disorders. Non-parametric Spearman correlation analysis and regression analysis were performed on the factors affecting the occurrence and severity of depression.

Results: Among 645 medical staff, 548 (85%) responded. The 1-year prevalence of depression was 42.7% and the prevalence of depression combined with anxiety, headache and sleep disorders was 23%, 27% and 34.5%. The prevalence of depression in females, nurses, unmarried or single group, and rotating-shift population was significantly higher than that in males(48.3% vs 27.1%, OR=2.512), doctors(55.2% vs 26.7%, OR=3.388), married group(50.5% vs 35.8%, OR=1.900), and day-shift population(35.2% vs 7.5%, OR=1.719). The occurrence of depression was correlated with anxiety, sleep disorder, headache and migraine, with anxiety being the most significant (Spearman Rho = 0.531). The SDS was significantly correlated with SAS and PSQI (Spearman Rho = 0.801, 0.503), and also related to the presence of headache and migraine (Spearman Rho = 0.228, 0.159). Multivariate logistic regression indicated that nurse occupation and anxiety were risk factors for depression, while grades of anxiety, sleep disorders and nurse occupation were risk factors for depression degree in multiple linear regression.

Conclusion: The prevalence of depression in medical staff is higher than that in the general population especially among females, nurse occupation, unmarried people and rotating-shift population. Depression is associated with anxiety, sleep disorders, headache and migraine. Anxiety and nurse occupation are risk factors for depression. This study might provide a reference for the promotion of occupational health among medical staff.

1. Introduction

The 2019 Global Burden of Diseases Study(GBD)reported that depression ranked second in years lived with disability (YLDs) and headache disorders ranked third among all age groups and both genders[1, 2]. What’s more, the global incidence of depression is still increasing rapidly. And WHO predicts that depression will become the first disease burden by 2030.

A survey of adult mental disorders covering 31 provinces and cities in China from 2013 to 2015 showed that the lifetime prevalence of depressive disorders in Chinese adults was 6.8%, but only 0.5% of patients received adequate treatment[3]. Faced with high-intensity and demanding work, medical staff often suffered from depression, anxiety, headache and sleep disorders, which not only cause pain to individuals

and families, but also affect work efficiency, damage social productivity and cause the social burden. Another meta-analysis based on clinical studies and population surveys from 2000 to 2020 suggested that primary headache comorbidities include depression, hypertension, anxiety, diabetes, sleep disorders, etc[4]. Thus, depression, anxiety, headache, and sleep disorders are highly prevalent and often interact with each other, but are not fully recognized or treated.

Our research team had conducted an epidemiological survey on the prevalence of primary headache among medical staff in Sanya City, Hainan Province, and found that the prevalence of primary headache among the medical staff was higher than that of the general population[5]. On the basis of the previous investigation, we added depression and anxiety related score data, and investigated the correlation between depression, anxiety, headache and sleep disorders and the risk factors of depression so as to provide data for improving the health status of the medical staff.

2. Methods

2.1 Survey Methods

This is a cross-sectional study. The research protocol was approved by the Ethics Committee of Beijing PLA General Hospital. All patients were informed of the purpose of the study and provided informed consent prior to participation.

The survey subjects were medical staff randomly selected from three tertiary A hospitals (Hainan Hospital of Chinese PLA General Hospital, the Third People's Hospital of Hainan Province, and the People's Hospital of Sanya) and one secondary A hospital (the Chinese PLA No. 425 Hospital) in Sanya, South China, from May 2018 to October 2018. After a preliminary survey of one department in each hospital, stratified random cluster sampling was used according to epidemiological methods. All physicians and nurses were invited to participate in surveys on depression, anxiety, headache and sleep disorders in eight clinical departments randomly selected from each hospital. The survey was divided into two parts: the questionnaire and the interview (face-to-face interview and a telephone interview). All participants who reported depression, anxiety, headache and sleep disorders were interviewed after their questionnaires were reviewed by neurological and psychiatric specialists. The notes to the questionnaire were explained and the participants' questions were answered in reference to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) and International Classification of Headache Disorders, Third Edition (ICHD-3) criteria. Each participant completed structured questionnaires and data was collected on demographics, occupation-related factors, and characteristics such as depression, anxiety, headache and sleep disturbances over the past year.

2.2 The questionnaire

The questionnaire consists of four parts.

1. Demographic data and medical professional characteristics includes Gender, Age, Marital status (Single or divorced people or Married), Body mass index (BMI, graded as Underweight, Normal Weight, Overweight, Obese), Educational background (College or lower, Bachelor's degree, Master's degree or above), Occupation (Doctor or Nurse), Work Seniority, Professional titles (Junior, Senior or Advanced), Work arrangements (Day-shift or Rotating-shift), Number of night shifts, etc. For this part of the data, we referred to the results of our previous survey.
2. The Self-rating Depression Scale (SDS) and the Self-rating Anxiety Scale (SAS) include 20 items that measured mental, physical, and emotional symptoms and were rated by respondents on how well each item had been used in the past week, using a 4-point scale ranging from 1 (none, or very little) to 4 (most or all of the time), calculating the raw score and converting it into a standard score. The SDS scores were 53–62 for mild depression, 63–72 for moderate depression, and > 72 for severe depression. The SAS scores of 50 to 59 were classified as mild anxiety, 60 to 69 as moderate anxiety, and > 69 as severe anxiety. Both scoring systems have been shown to have good internal consistency, and the Cronbach alpha coefficients of the two scores were 0.81 and 0.82, respectively[6].
3. The headache profile section (25 questions) includes headache nature, headache degree (Visual Analogue Score, VAS), headache frequency, accompanying symptoms, aggravating and alleviating factors, etc. The reliability and validity of the Chinese version of the questionnaire for headache diagnosis have been tested in China and has been used in the nationwide demographic headache epidemiological investigation[7–9]. In this questionnaire, headache disorders include migraine, tension-type headache (TTH) and other types such as neuralgia, chronic daily headache (CDH), and unclassified headaches, while trigeminal autonomic cephalalgias (TACs), other primary headache disorders, and secondary headaches were not included.
4. The Pittsburg Sleep Quality Index (PSQI) uses 18 self-rated items to evaluate seven dimensions of sleep. Each dimension is scored on a scale of 0 to 3, and the total PSQI score for each dimension is 0 to 21 points. PSQI scores are 0 to 5 for normal sleep, 6 to 10 for mild sleep disorders, 11 to 15 for moderate sleep disorders, and 16 to 21 for severe sleep disorders. In most studies, the alpha coefficient of Cronbach of PSQI score was between 0.70 and 0.83, showing good internal consistency[10].

2.3 Statistical analysis

Epidata 3.1 was used for data entry, and SPSS 26.0 was used to conduct the statistical analysis. Continuous variables that did not comply with the normal distribution were summarized as medians, and categorical variables were summarized as numbers and percentages.

Firstly, depression, anxiety, headache and sleep disorders were defined as binary variables. Two subcategories of headache, migraine and TTH, were also used as variables. For correlation analysis of binary data Pearson's chi-square test was used. For the quantitative variables, the Mann Whitney test was applied. Because there is hierarchical data in demographic data, we used nonparametric spearman correlation analysis. Then, considering that SDS scores are continuous variables but do not conform to

normal distribution, spearman correlation analysis was also used and calculated spearman correlation coefficient (Rho). The statistical significance level was set at $P < 0.05$.

Multivariate logistic regression analysis was used to identify odds ratios (OR) and 95% confidence intervals (CIs) according to demographic and occupational characteristics, anxiety, different types of headaches and sleep disorders. Independent variables with a P-value < 0.10 were included in the candidate variables of the logistic regression model for depression, and the significance of screening parameters ($P < 0.05$) and the absence of multicollinearity variables were screened. To choose the model that best fits the data to predict depression. We also established multiple linear regression models to predict the severity of depression.

3. Results

A total of 645 medical staff (280 physicians and 365 nurses) were invited to participate in this study, among whom 22 refused to complete the survey for some reason. Another 75 participants answered the questionnaire incompletely or did not meet the response requirements, with a correct response rate of 85%. A total of 548 respondents completed the survey (240 physicians and 308 nurses). There were 144 males and 404 females, aged between 20 and 60 years, with a median of 28 years (doctors = 31 years, nurses = 27 years).

Among 548 medical staff, the 1-year prevalence of depression was 42.7% (mild 26.8%, moderate and severe 15.9%), the prevalence of headache disorders was 53.3% (migraine 25.9%, TTH 24.1%, other types 3.3%), and the prevalence of anxiety and sleep disorders was 26.6%, and 69.0%, respectively. Among them, depression combined with anxiety, headache, and sleep disorders was 23%, 27% (migraine 14.4%, TTH 10.4%), and 34.5%, but only 11 respondents (4.7%) have received psychiatric medication for depression.

We found that the prevalence of depression in females was significantly higher than that in males (48.3% vs 27.1%, OR = 2.512), and females were about five times as likely to have depression as males were (35.6% vs 7.1%). The median age of the depressed group (28 years) was lower than that of the non-depressed group (30 years). And the prevalence of depression in unmarried or divorced people was significantly higher than that in the married group (50.5% vs 35.8%, OR = 1.900). The prevalence of depression among nurses was nearly twice as high as among doctors (55.2% vs. 26.7%, OR = 3.388), and among rotating-shift workers was significantly higher than that among day-shift workers (35.2% vs. 7.5%, OR = 1.719). The total prevalence of overweight and obesity in the medical population was about 33.1%, among which 10.6% were depressed, while 32.1% were depressed in the population with a BMI < $23kg/m^2$. In addition, with the improvement of educational background and professional titles, the prevalence of depression has gradually decreased.

The prevalence of mild, moderate, and severe anxiety was all higher in patients with depression than in those without depression. The prevalence of migraine was higher in the depressive group (55.6% vs

44.4%, OR = 2.031), while the prevalence of TTH was higher in the non-depressive group (43.2% vs 56.8%). In comparison with the sleep disorder group, we found that the prevalence of mild sleep disorders was similar in the two groups, while the prevalence of moderate and severe sleep disorders was higher in the depressive group. We showed these results in Table 1.

Table 1
Comparison of the medical staff characteristics with and without depression

		With depression(n = 234)	Without depression(n = 314)	P-value	OR(95%CI)
Sex(n %)	Male	39(27.1%)	105(72.9%)	< 0.001	0.398(0.263–0.604)
	Female	195(48.3%)	209(51.7%)		
Age	Median	28.0	30.0	< 0.001	1.833(1.302–2.582)
	(P25,P75)	(25,30)	(26,35)		
Marital status	Single or divorced	129(51.2%)	126(48.8%)	< 0.001	1.900(1.348–2.678)
	Married	105(35.6%)	188(64.4%)		
BMI	Underweight < 18.5	51(56.0%)	40(44.0%)	0.001	0.295(0.205–0.425)
(kg /m^2)	Normal Weight 18.5–22.9	125(45.5%)	150(54.5%)		
	Overweight 23–25	26(31.3%)	57(68.7%)	< 0.001	1.716(1.186–2.483)
	Obese ≥ 25	32(32.3%)	67(67.7%)		
Occupation	Doctor	64(26.7%)	176(73.3%)	< 0.001	4.126(1.963–8.673)
	Nurse	170(55.2%)	138(44.8%)		
Educational background	College or lower	101(54.6%)	84(45.4%)	0.021	0.582(0.382–0.885)
	Bachelor	124(41.2%)	177(58.8%)		
	Master or above	9(14.5%)	53(85.5%)	0.011	2.698(1.629–4.467)
Work Seniority(year)	Median	5	6		
	(P25,P75)	(3,8)	(3,12)		
Work arrangements	Day-shift	41(32.8%)	84(67.2%)	0.003	1.187(0.524–2.691)
	Rotating-shift	193(45.6%)	230(54.4%)		
Night shifts	Median	5	5	< 0.001	
	(P25,P75)	(4,8)	(0,7)		
Professional titles	Junior	199(48.8%)	209(51.2%)	< 0.001	17.150(10.188–28.869)
	Senior	24(26.1%)	68(73.9%)		
Anxiety		11(8.8%)	37(77.1%)		
		126(86.3%)	20(13.7%)		
		69(79.3%)	18(20.7%)		

		With depression(n = 234)	Without depression(n = 314)	P-value	OR(95%CI)
		42(95.5%)	2(4.5%)	< 0.001	2.032(1.437–2.872)
		15(100%)	0		
Headache	Advanced	148(50.7%)	144(49.3%)		
	Total	79(55.6%)	63(44.4%)	< 0.001	2.778(1.870–4.127)
	Mild	57(43.2%)	75(56.8%)		
Sleep disorders	Moderate	189(50.0%)	189(50.0%)		
	Severe	104(39.5%)	159(60.5%)		
	Total	77(72.0%)	30(28.0%)		
	Migraine	8(100%)	0		
	Tension-type headache				
	Total				
	Mild				
	Moderate				
	Severe				

We first used nonparametric spearman correlation analysis of binary classification variables of depression and anxiety, headache, and sleep disorders, and then we examined the correlation with demographic characteristics factors. The results showed that the occurrence of depression and anxiety, sleep disorders, total headache and migraine have correlation, with the correlation coefficient of anxiety the biggest (Spearman Rho = 0.531). However, there was no significant correlation between TTH and depression. Other related factors included age, gender, BMI, professional title, educational background, marital status, occupation, work arrangements, night shifts, etc(see Fig. 1). We then performed a multifactor binary logistic regression analysis on the occurrence of depression. The TTH, headache frequency and VAS scores of headache intensity were found to be $P > 0.1$ in the early screening process, so it was not included in the regression model. The results showed that anxiety and nursing occupation were risk factors, while BMI was the protective factor for depression (see Table 2 and Fig. 2).

Table 2
Multivariate logistic regression of depression occurrence

	B	Standard error	P-value	Exp(B)	Exp(B)95%CI
Constant	0.191	1.276	0.881	1.210	
Anxiety	2.791	0.291	< 0.001**	16.298	9.208 ~ 28.847
Sleep disorders	0.228	0.248	< 0.360	1.256	0.772 ~ 2.043
Headache	0.286	0.229	0.212	1.331	0.850 ~ 2.085
BMI	-0.078	0.036	0.032*	0.925	0.861 ~ 0.993
Education background	-0.226	0.197	0.250	0.797	0.543 ~ 1.172
Age	-0.001	0.030	0.962	0.999	0.942 ~ 1.058
Nurse occupation	0.965	0.328	0.003**	2.626	1.381 ~ 4.993
Gender	-0.507	0.354	0.153	0.603	0.301 ~ 1.206
Marital status	0.487	0.274	0.076	1.627	0.950 ~ 2.785
Work arrangements	-0.026	0.477	0.956	0.974	0.383 ~ 2.479
Night shifts	0.405	0.062	0.467	1.046	0.927 ~ 1.180
Professional title	0.029	0.311	0.926	1.029	0.560 ~ 1.893
(Note : Hosmer-Lemshaw test P = 0.545, 78.5% of correct predictions)					

We further analyzed the correlation between SDS scores of depression severity and quantitative variables of SAS, PSQI, headache frequency, and headache intensity VAS scores as well as demographic data. The results showed that the severity of depression was significantly correlated with the severity of anxiety and sleep disorders (Spearman Rho = 0.801, 0.503), and the presence or absence of headache and migraine was also related. However, there was no significant correlation between SDS scores with headache frequency, headache intensity and TTH, but headache frequency and headache intensity could affect the PSQI score of sleep disorders (Spearman Rho was 0.205, 0.166, P < 0.001). In addition, the results showed that the severity of depression was positively correlated with nurse occupation, night shifts, and working arrangements and negatively correlated with age, gender, marital status, BMI, educational background, professional titles, and so on (see Fig. 3).

Then we performed multiple linear regression analysis on the SDS scores to predict depression severity. The VAS scores of headache intensity were found to be P > 0.1 in the early screening process, so it was not included in the regression model. Considering the multicollinearity between age, working years and

professional title, medical profession and gender, working arrangement, and night shift frequency, we included only variables such as age, nurse occupation, and night shift frequency. According to the results of multiple linear regression, anxiety, sleep disorders, and nurse occupation were the risk factors, while educational background was the protective factors for depression severity (see Table 3 and Fig. 4).

Table 3
Multiple linear regression of the SDS score

	Coefficient	Standard error	P-value	95%CI of B	VIF
Constant	52.152	3.897	< 0.001	44.496 to 59.807	
SAS grade	7.932	0.584	< 0.001**	6.786 ~ 9.078	1.378
PSQI grade	3.310	0.607	< 0.001**	2.118 ~ 4.502	1.468
Headache	1.165	0.801	0.146	-0.409 ~ 2.739	1.144
BMI	-0.284	0.108	0.088	-0.497~-0.072	1.207
Education background	-1.614	0.622	0.010**	-2.837~-0.392	1.575
Age	-0.101	0.072	0.159	-0.242 ~ 0.040	1.920
Nurse occupation	1.998	0.976	0.041*	-0.081 ~ 3.915	1.679
Marital status	-0.497	0.906	0.584	-2.277 ~ 1.284	1.562
Night shifts	0.052	0.129	0.684	-0.201 ~ 0.306	1.140
(Note: adjusted R^2 0.495, F 60.623 P < 0.001)					

4. Discussion

Prevalence—The prevalence of depression in the medical population was significantly higher than that in the general population, especially among females and nurses. The estimated prevalence of depression among resident doctors in a 2015 systematic review was 28.8%, ranging from 20.9–43.2% depending on the assessment tools used[11]. Many researches have reported that the prevalence of depression among nurses ranges from 18–64.8%[12–16], and some studies have suggested that the prevalence of depression among nurses was nearly twice that of other professional individuals[17]. The prevalence of depressive symptoms among Chinese nurses between 1996 and 2019 was about 43.8%[18]. In our study, the prevalence of depression among physicians and nurses was 26.7% and 55.2%, which is consistent with the results of previous reports and also indicates that the mental health of nurses needs more attention from society.

Risk factors—The occurrence of depression was correlated with anxiety, sleep disorders, headache and migraine, among which the correlation with anxiety was the strongest. Previous studies have most

consistently identified risk factors for depression, including: cognition and cognitive processes, stressors, sociodemographic factors (e.g., being female), parental depression, and certain behaviors and personalities. Stress is a risk factor for depression, and more than 80% of individuals in the community sample who meet the criteria for clinically significant depression have experienced a recent major life event or persistent stressor. And these risks and depression interact in a bidirectional and dynamic manner[19]. As medical staff need to face multiple stresses from patients, society, family and individuals, and stresses often lead to people's anxiety in the first place. Anxiety disorders usually first appear in early childhood and adolescence, long before depression develops, and 56% of people with anxiety disorders develop depression. Anxiety disorders can be described as a risk factor for secondary depression in this age group[20]. Our study found that anxiety was significantly correlated with the occurrence and severity of depression, and stress may be the dominant factor behind it. The process changes of neurobiological substrates related to stress regulation and the maladjustment of transmitter activity are the possible mechanisms of anxiety and depression[21]. We also found that the higher the education level, the lower the prevalence and severity of depression. This is because people with different degrees have different levels of self-regulation and cognitive ability to cope with stresses, and many studies have shown that highly educated adults have lower levels of depression. So we think there is a cognition-stress-anxiety-depression relationship line.

Headache and depression—Our survey found that the occurrence of depression was associated with the presence or absence of headache or migraine, but there was no significant correlation between the severity of depression and the severity score of headache, which was consistent with previous reports[22]. The association between headache and depression went both ways, with depressed patients having an increased risk of migraine and migraineurs having an increased risk of depression. What’s more, the symptoms of migraine and depression are more severe than those who suffer alone[23, 24]. There have also been reported that the frequency of headaches affects depression scores[25]. In our study, no significant difference was found between the groups with and without depression in TTH, which is different from the results of the general population sample[26]. There are few epidemiological data on TTH among medical staff. The reasons for the difference are considered to be related to the characteristics and working modes of medical staff, among whom TTH are more likely to be induced by long-term desk work and frequent night shifts.

Sleep disorders and depression—In our survey, sleep disorders were significantly associated with the occurrence and severity of depression. The current relationship between depression and sleep disorders is thought to be reciprocal. A longitudinal study has shown that both anxiety and depression are significantly linked with the incidence, but not the persistence, of sleep disorders[27]. Studies have also identified sleep disorders as an independent risk factor for the onset or recurrence of depression in young, middle-aged and older adults[28, 29]. Also, one of the symptoms most consistent with major depressive disorder (MDD) is sleep disturbance[30]. In addition, depressed patients with sleep disorder tend to have more severe depressive symptoms, longer treatment times and lower remission rates[31]. Therefore, we should pay more attention to the intervention of sleep disorders while treating depression.

BMI and depression—There have been many studies on the relationship between depression and BMI, but consistency has been poor. From negative correlation studies[32–36] on "happy obesity" to positive correlation studies[37, 38], there are also studies showing that the correlation between BMI and depression can be ignored[39]. Our results showed that BMI was negatively associated with the occurrence of depression, but the correlation coefficient was small. The reason for this difference may be that different ages, genders, and educational backgrounds have different cognitions of body shape, and further stratified research on the relationship between BMI and depression is needed.

5. Limitations

Our study relied on the participants' own memories, and recall bias may affect the reliability of survey data. Moreover, only one assessment tool was used for each disease, which is the defect of our study. Multiple assessment tools and objective examinations can be combined to refine the stressors of the medical population for further analysis. At the same time, as a cross-sectional study, we found associations between depression, anxiety, headache and sleep disorders, but could not disentangle cause and effect. It is well known that genetic factors play an important role in the development of depression, but family history of depression and other factors such as alcohol use and sun exposure time were not included in our survey, which should be explored in future studies.

6. Conclusions

Overall, emotional disorders like depression are more prevalent in the healthcare population, especially among females and nurses, but rarely attract attention and lack effective treatment. Depression, anxiety, headaches, and sleep disorders often co-occur and interact with each other. Assessment of mood, headache and sleep problems is of great significance for better and more effective prevention and treatment of depression in the medical staff.

Declarations

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Authors’ contributions

Dr. GL was responsible for reviewing the literature and writing the manuscript. Dr. SX was responsible for data statistics. Dr. WX and WG provided previous raw data and guidance. Dr. JH, FM, and YY were responsible for issuing and recalling the SDS/SAS/PSQI questionnaires. Dr. RL and SY were the principal investigators who were responsible for study design, data analysis and interpretation, and revision of the manuscript. As co-corresponding authors, Dr. RL and SY had full access to all the data in the study and had final responsibility for the decision to submit for publication. All authors read and approved the final manuscript.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The ethics committee of the Chinese PLA General Hospital approved this study. All respondents were informed of the purpose of the study. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

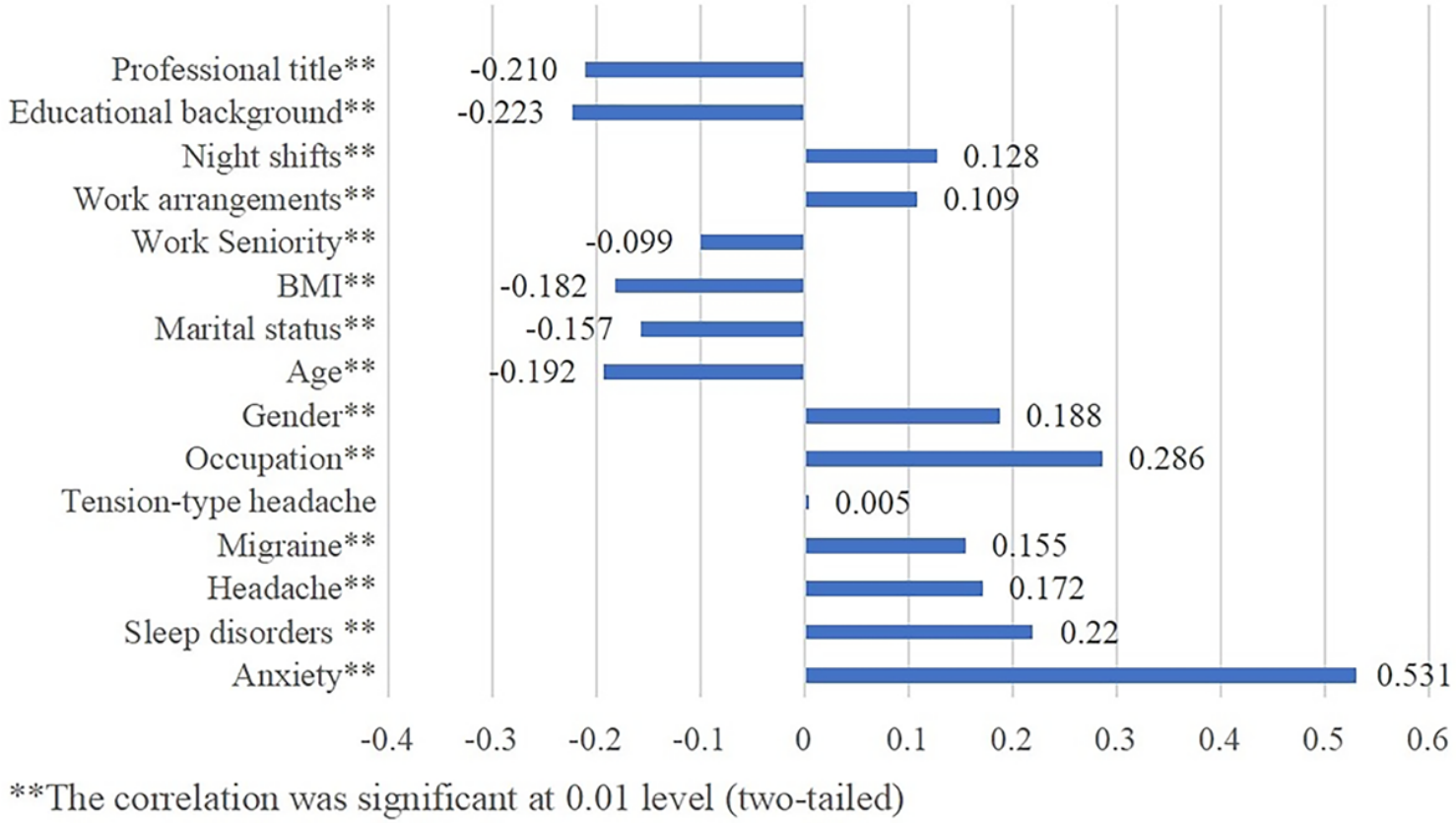

Figure 1

Nonparametric Spearman correlation analysis of depression occurrence

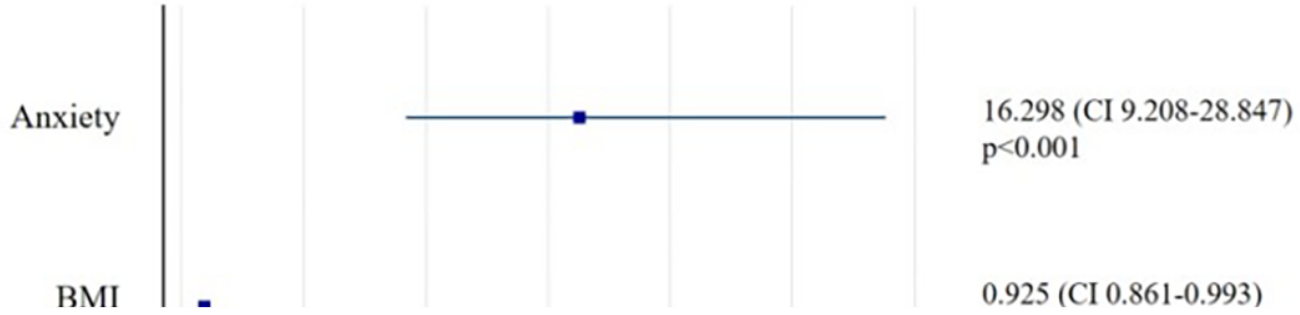

Figure 2

Multivariate logistic regression of depression occurrence

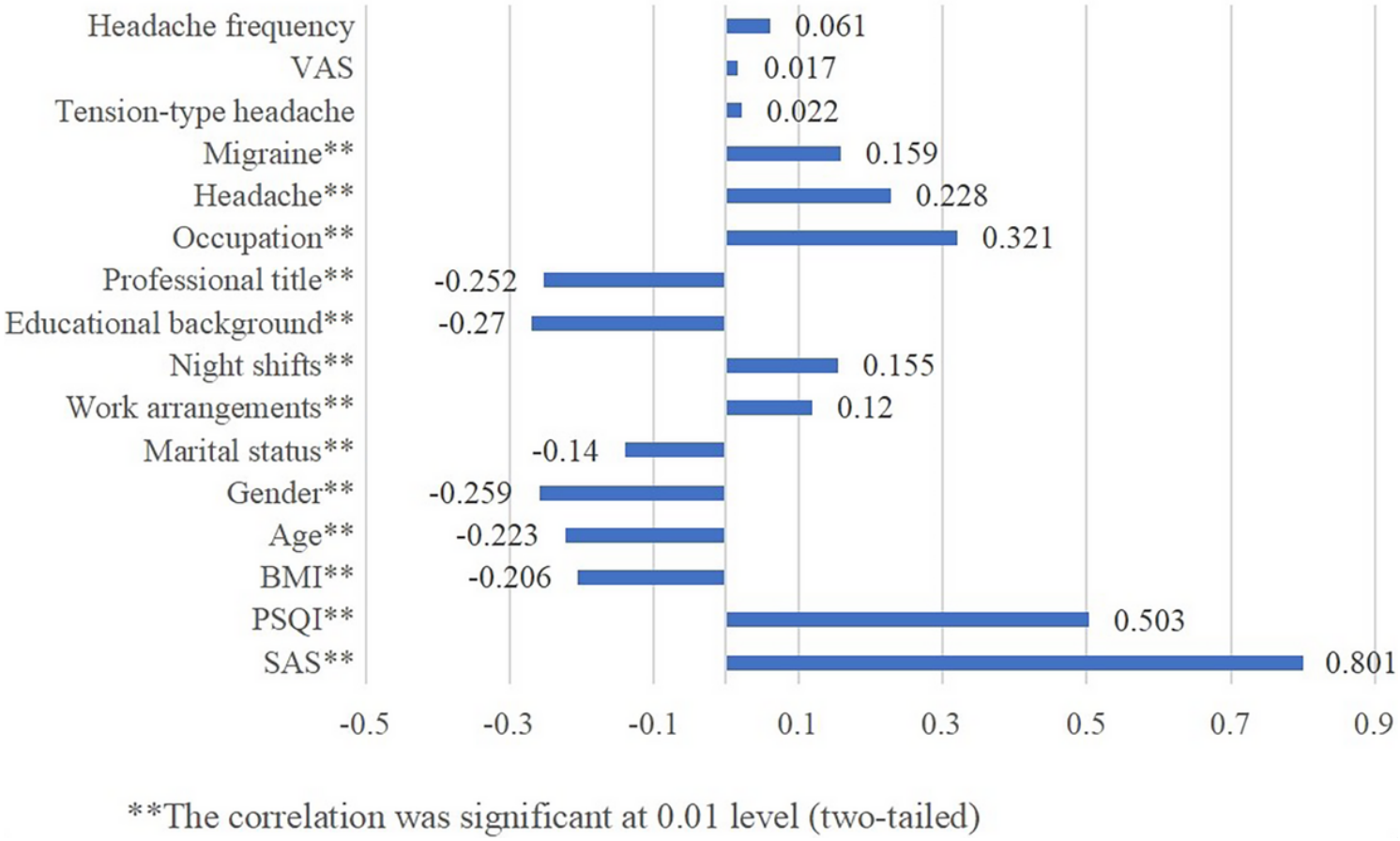

Figure 3

Nonparametric Spearman correlation analysis of the SDS score

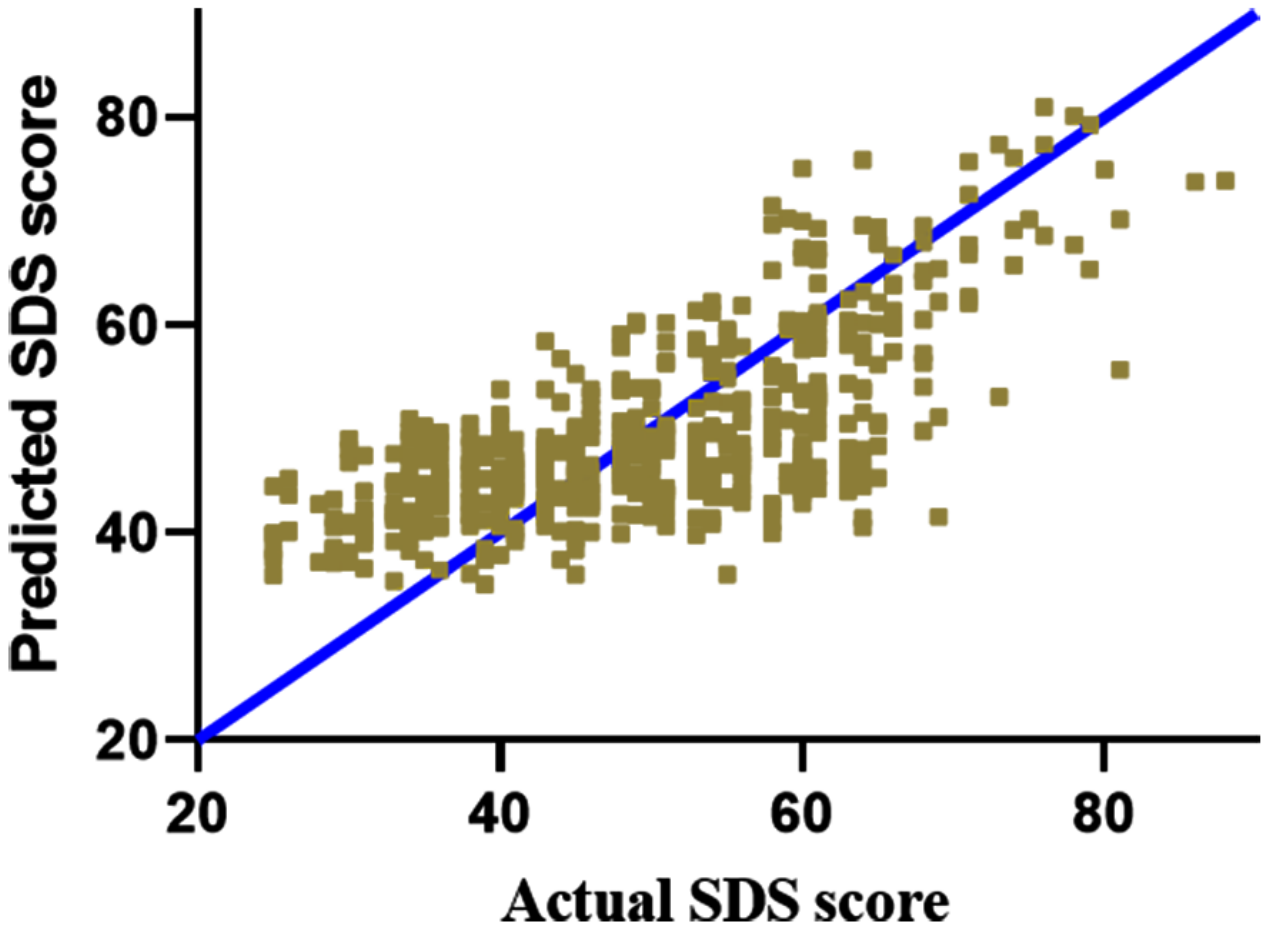

Figure 4

Actual vs Predicted plot: Multiple linear regression of the SDS score