THE MEDIATING EFFECT OF PSYCHOLOGICAL FLEXIBILITY ON FATIGUE AND DEPRESSIVE SYMPTOMS AMONG NURSING STAFF

YONGCHENG YAO[1], JIE TANG[2], HONGLING MENG[1], YUPING LI[1], HAIXIA DU[1], and ZHENZHEN LI[1]

[1] Zhengzhou Normal University, Zhengzhou, China
School of Mathematics and Statistics

[2] Zhengzhou University of Technology, Zhengzhou, China
Library

Abstract

Objectives: To explore the relationship between depressive symptoms, fatigue and psychological flexibility, as well as their interactions on depression in Chinese nurses. **Material and Methods:** Using convenience sampling, a cross-sectional survey of 796 nurses in municipal hospitals of Zhengzhou, Henan Province, China, was conducted. The questionnaires of *Work-related Acceptance and Action Questionnaire*, *Center for Epidemiological Studies Depression Scale* and *Fatigue Assessment Instrument* were used. Hierarchical regression and bootstrap methods were used to examine the mediating effect of psychological flexibility between fatigue and depression. **Results:** More than 51.8% of the nurses were at risk of depression and 62.3% were at risk of fatigue. There was a significantly positive and moderate correlation between depression and fatigue severity, situation specificity, and consequences (r = 0.43, r = 0.24 and r = 0.31, respectively, p < 0.01). Depression was negatively correlated with psychological flexibility (r = −0.28, p < 0.01). Psychological flexibility had a negative impact on depression with the explained variance increased by 4.2% (β = −0.211, p < 0.001). The bootstrap method showed that the mediating effect of psychological flexibility accounting for 8.5% and 12.3% on fatigue and depressive symptoms, respectively. **Conclusions:** Psychological flexibility plays a partial mediating role between the fatigue severity, consequences of fatigue and depressive symptoms of nurses. Hospital managers should improve medical staff work acceptance to alleviate their depressive symptoms. Int J Occup Med Environ Health. 2023;36(4):563–74

Key words:
fatigue, depressive symptoms, nurses, bootstrap, psychological flexibility, mediating effect

INTRODUCTION

Depression is a common and serious mental disorder, which is characterized by feeling sad and having a depressed mood. Depression negatively affects one's feeling, thoughts and action, leading to loss of interest or pleasure in activities, alteration of appetite, aberrant sleeping, feeling fatigue, even tendency to suicide. The global burden of depression increased by 49.86% during the period of 1990–2017 [1]. Its prevalence in China is much higher than that in high-income nations (21.53–32.77%) and the general population worldwide (4.40% in 2015) [2–4]. A recent meta-analysis study

showed that the prevalence of depression was 33.03% (95% CI: 27.40–29.19) in healthcare workers in the Eastern Mediterranean Region (EMR) [5]. In addition to general stressors in their personal lives, healthcare workers usually also face exceedingly high levels of academic and professional stress, which can result in emotional exhaustion and burnout [6–8]. Healthcare workers suffering from depression may negatively affect the quality of services they provide to patients, leading to patient dissatisfaction, medical mistakes, and associated financial costs. In some severe cases, patient safety may be compromised.

Research has suggested that the effectiveness of depression treatment is associated with reductions in the severity of fatigue symptoms [9]. It is significantly higher in patients with depression than that in normal controls [10]. Fatigue refers to physical discomfort and reduced work efficiency after prolonged or overwork. Several cross-sectional studies have reported an association between fatigue and depression [11–13], and nursing staff are a high-risk group of fatigue [14].

Job-related psychological flexibility refers to one's ability to persist with acceptance behavior in pursuit of goals and values and to engage the work no matter how painful thoughts and feeling, such as stress and anxiety an individual experiences [15]. Psychological flexibility is a protective factor for several mental disorders including depression. Individuals who have high psychological flexibility can help employees take advantage of beneficial resources in the work environment and better adapt themselves to the work environment [16–18]. The results from another study also suggest that high psychological flexibility is a protective factor [19], and individuals can still work efficiently even when they face stress and/or difficulties or challenges in the workplace. Therefore, psychological flexibility could play a key role in psychological health-related outcomes [20], and high psychological flexibility empowers individuals with resilience strength to cope up with adverse situations.

It has been shown that depression occurs in 52.4% of professional healthcare workers in China [21], suggesting that healthcare workers are one of the groups at high risk of depression. A relationship between fatigue and depression has long been suspected. Therefore, this study used multiple regression and bootstrap analysis to explore the relationship between depressive symptoms, fatigue, and psychological flexibility in nurses, to provide theoretical support and suggestions for improving the physical and mental health of this group.

MATERIAL AND METHODS
Participants
This study was conducted through a convenience sample of registered nurses from 4 municipal hospitals in Henan Province, China, June–August 2015. The criteria for inclusion were those who were registered nurses and had worked in a nurse position for at least 1 year and had no physical or mental illness. All participants provided informed consent in this study. All procedures performed in this study involving the participants were approved by the institutional research ethics review committee of Zhengzhou Normal University, China (ZZNU-2015-002), in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Based on the criteria, the questionnaire collected general information of demographics for each participant, e.g., sex, age, professional experience, marital status, department and job title.

Method
Depressive symptoms
The *Center for Epidemiologic Studies Depression Scale* (CES-D) is a 20-item, self-administered scale which measures depressive symptoms in the previous 1 week [22]. The original author recommended a cut-off score of ≥16 in CES-D to identify those with depression. Each item uses a Likert scale from 0 ("never or rarely") to 3 ("most of the time or all of the time"). Summed scores range 0–60, whereby higher scores

represent increased levels of depressive tendency. In this study, the scale Cronbach's α was 0.948.

Psychological flexibility

The *Work-related Acceptance and Action Questionnaire* (WAAQ) was used to measure psychological flexibility in relation to the workplace [23]. Reliability and validity of the scale has been evaluated in Chinese sample with high quality, and it is suitable for testing in medical staff [24]. The items reflect the extent to which people can take goal-directed action in the presence of difficult internal experiences. The WAAQ includes 7 items rated on a 7-Likert scale from 1 ("never") to 7 ("always"). The total score of the WAAQ ranges 7–49. Higher scores indicate better psychological flexibility, better job acceptance, and greater work activity. The Cronbach's α in this study was 0.816.

Fatigue Assessment Instrument

Fatigue Assessment Instrument (FAI) is a 29-item questionnaire that was designed to assess both quantitative and qualitative aspects of fatigue [25]. The FAI has 4 subscales: *Global Fatigue Severity*, *Situation Specificity*, *Consequences of Fatigue* and *Responsiveness to Rest/Sleep*, with extra dimensions providing information on situational aspects of fatigue. The FAI is rated on a 7-point Likert scale, and it assesses fatigue over the prior 2 weeks. The FAI score is calculated by the average of the 4 subscales with each subscale score being an average of the items in each subscale. A higher score indicates more fatigue. A global fatigue severity score >4 is generally considered to be confirmatory of the diagnosis of fatigue [26]. Global fatigue severity was found to be <4 in 90% of normal subjects [25]. Cronbach's α for the FAI scales in this study were 0.916, 0.768, 0.898 and 0.905, respectively.

Data analysis

Data were recorded and analyzed using SPSS 18.0 and PROCESS v. 4.0. The measurement data showed an ap-

proximately normal distribution by the normality test (Skew and Kurtosis absolute values were all <1). Numerical variables were presented as mean (M) ± standard deviation (SD). A 2-tailed test yielding p < 0.05 was considered statistically significant. Either t-test or analysis of variance (ANOVA) was used to analyze differences between groups, and *post hoc* Bonferroni tests were performed to verify differences between specific groups in analyzing associations of demographic variables with psychological flexibility, fatigue and depression in nurses. Pearson's correlation analysis was performed for the correlations between psychological flexibility, all dimensions of fatigue and depression. Hierarchical regression and bootstrap methods were used to examine the mediating effect of psychological flexibility between fatigue and depression.

RESULTS

Common method variance test

The Harman's single factor test was used to measure the common method variance (CMV). The result showed no severe CMV existing in this study. Eight factors had eigenvalues >1, and 27.71% of the variance was explained by the first factor, which is less than the criterion of 40% [27].

Demographic data

A sample of 796 among the 900 Chinese nurses who worked in general hospitals selected for participation in this study consented to participate and completed the survey. The demographics of the sample are presented in Table 1.

Associations of demographic variables with depression, fatigue and psychological flexibility in nurses

The score of the depression was M±SD 17.22±10.69, and 51.8% of the nurses were at risk of depression. The scores

Table 1. Demographic characteristics of the nurses, study conducted in 2015, Henan Province, China

Variable	Participants (N = 796)		M±SD	Range
	n	%		
Gender				
male	40	5.0		
female	756	95.0		
Marital status				
single	308	38.7		
married	488	61.3		
Age [years]			28.78±5.45	8–53
<25 years	156	19.6		
25–29 years	344	43.2		
30–34 years	196	24.6		
≥35 years	100	12.6		
Length of service [years]			7.50±6.01	1–33
1–5 years	372	46.7		
6–15 years	234	29.4		
≥16 years	190	23.9		
Job title				
primary	646	81.2		
intermediate	150	18.8		
Department				
emergency	76	9.5		
surgical	185	23.2		
pediatric	34	4.3		
obstetrics and gynecology	96	12.1		
internal medicine	222	27.9		
medical technology	34	4.3		
administration	149	18.7		

of the 4 dimensions of fatigue were M±SD 4.41±1.37, 4.91±1.19, 4.70±1.64 and 5.82±1.53, respectively. Most nurses (62.3%) were at risk of fatigue. The score of the psychological flexibility was M±SD 33.52±7.66.

Association analytic results are shown in Table 2. There was statistically significant association between gender and circumstances (p < 0.05), with females having higher fatigue than males. Significantly higher fatigue severity was also found in married nurses, compared with single nurses (p < 0.01). The differences were significant in the scores of fatigue severity and circumstances among nurses with different age groups (p < 0.01). *Post hoc* test results showed that nurses in ≥25 years and ≥30 years group scored significantly higher on the fatigue severity than nurses <25 years (p < 0.01), while nurses in ≥30 years group scored higher on the circumstances than nurses aged <25 years (p < 0.05). In addition, the differences were significant in the scores of depression, fatigue severity, circumstances and rest/sleep among nurses with different working length (p < 0.05). A *post hoc* test showed that depression, fatigue severity, circumstances and rest/sleep scores of ≥6 years of service group were higher than ≥1 year of service group (p < 0.05). The depression scores of ≥11 year of service group were higher than ≥1 year of service group (p < 0.05).

This study also found a significant difference in fatigue severity, consequences, psychological flexibility between departments (p < 0.05). Nurses working in the emergency department showed a higher fatigue severity than those working in pediatric and obstetrics and gynecology departments (p < 0.05). Nurses working in internal medicine showed a higher fatigue severity than those working in surgical, pediatric, administration, obstetrics and gynecology departments (p < 0.05). No significant associations were found between different departments and either consequences, or psychological flexibility (p > 0.05) (Table 2).

Pearson's correlations between depression, fatigue and psychological flexibility

There was a significantly positive and moderate correlation between depression and fatigue severity, situation specificity, and consequences (r = 0.43, r = 0.24 and r = 0.31, respectively, p < 0.01). Depression was signifi-

Table 2. Associations of demographic variables with depression, fatigue and psychological flexibility in nurses, study conducted in 2015, Henan Province, China

Variable	Factor					
	depression	fatigue severity	circumstances	consequences	rest/sleep	psychological flexibility
Gender						
male (M±SD)	15.58±9.29	4.16±1.10	4.55±1.08	4.74±1.21	5.29±2.07	32.25±7.29
female (M±SD)	17.31±10.76	4.42±1.38	4.93±1.19	4.70±1.66	5.84±1.49	33.59±7.68
t	−1.001	−1.466	−2.013*	0.213	−1.676	−1.077
Marital status						
single (M±SD)	16.76±10.27	4.24±1.38	4.81±1.22	4.73±1.60	5.73±1.66	32.88±7.37
married (M±SD)	17.51±10.95	4.51±1.36	4.98±1.16	4.68±1.66	5.87±1.44	33.92±7.83
t	−0.966	−2.718**	−1.872	0.449	−1.158	−1.869
Age						
<25 years (M±SD)	15.54±9.35	4.04±1.35	4.66±1.25	4.47±1.66	5.60±1.78	33.00±7.59
25−29 years (M±SD)	17.65±11.29	4.48±1.37	4.95±1.13	4.76±1.64	5.80±1.50	33.00±7.57
30−34 years (M±SD)	17.74±10.23	4.54±1.31	5.03±1.14	4.84±1.55	6.04±1.26	34.42±8.02
≥35 years (M±SD)	17.38±11.29	4.48±1.45	4.95±1.30	4.59±1.73	5.78±1.65	34.37±7.27
F	1.625	4.829**	3.163*	1.774	2.509	2.083
Length of service (years)						
1−5 years (M±SD)	16.01±10.14	4.24±1.37	4.78±1.19	4.58±1.66	5.68±1.63	33.41±7.63
6−15 years (M±SD)	18.27±11.19	4.59±1.36	5.04±1.13	4.85±1.60	6.03±1.31	33.07±7.80
≥16 years (M±SD)	18.32±10.91	4.52±1.35	5.00±1.22	4.74±1.63	5.81±1.56	34.29±7.54
F	4.558*	5.602**	4.186*	2.603	3.820*	1.416
Job title						
primary (M±SD)	17.20±10.54	4.38±1.37	4.90±1.17	4.69±1.62	5.83±1.52	33.40±7.72
intermediate (M±SD)	17.35±11.35	4.54±1.40	4.98±1.27	4.74±1.72	5.75±1.57	34.03±7.43
t	−0.156	−1.284	−0.823	−0.324	0.610	−0.908
Department						
emergency (M±SD)	18.01±11.87	4.67±1.30	5.00±0.98	4.97±1.53	5.84±1.45	31.83±7.52
surgical (M±SD)	15.59±10.05	4.34±1.41	4.87±1.28	4.56±1.70	5.88±1.41	33.42±7.79
pediatric (M±SD)	16.18±10.27	3.69±1.49	4.41±1.19	4.21±1.62	5.25±1.61	32.06±8.38
obstetrics and gynecology (M±SD)	16.79±9.36	3.99±1.44	4.82±1.21	4.42±1.73	5.88±1.51	35.28±6.81
internal medicine (M±SD)	19.04±11.38	4.76±1.34	5.06±1.20	4.91±1.64	5.87±1.52	32.97±8.10
medical technology (M±SD)	15.65±10.89	4.15±1.18	4.95±1.09	4.39±1.53	6.00±1.47	36.21±6.94
administration (M±SD)	17.01±10.37	4.33±1.21	4.86±1.11	4.79±1.51	5.68±1.72	33.92±7.15
F	2.085	6.581***	1.861	2.466*	1.174	2.660*

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Pearson's correlations of the variables in nurses, study conducted in 2015, Henan Province, China

Variable	M	SD	Pearson's correlation					
			1	2	3	4	5	6
1. Depression	17.22	10.69	1.000					
2. Fatigue severity	4.41	1.37	0.434**	1.000				
3. Circumstances	4.91	1.19	0.240**	0.533**	1.000			
4. Consequences	4.70	1.64	0.309**	0.539**	0.572**	1.000		
5. Rest/Sleep	5.82	1.53	0.025	0.253**	0.492**	0.185**	1.000	
6. Psychological flexibility	33.52	7.66	−0.284**	−0.153**	−0.021	−0.153**	−0.084*	1.000

* $p < 0.05$; ** $p < 0.01$.

cantly negatively correlated with psychological flexibility ($r = -0.28$, $p < 0.01$). There was a significantly negative correlation between psychological flexibility and fatigue severity, consequences and rest/sleep ($r = -0.15$, $r = -0.15$ and $r = -0.08$ respectively, $p < 0.05$) (Table 3).

The mediating effect of psychological flexibility between fatigue and depression

In Model 1, there was no statistically significant when only control variables such as sex, marriage, age, and length of service were included. Under the influence of control variables, the 4 dimensions of fatigue were included, and fatigue severity and consequences had a positive impact on increasing depression ($\beta = 0.391$, 0.022, $p < 0.05$). Rest/sleep were related with the reduction of depression ($\beta = -0.105$, $p < 0.01$), and the explained variance was 19.9%. After the introduction of psychological flexibility into the third layer, the explained variance increased by 4.2%, which had a negative impact on depression ($\beta = -0.211$, $p < 0.001$). The absolute value of the standardized regression coefficient for fatigue severity decreased from 0.391 to 0.357, with that of rest/sleep decreasing from 0.105 to 0.084. Both reductions for fatigue severity and rest/sleep were statistically significant. It suggested that psychological flexibility played a partial mediating role in the relationship between fatigue severity and rest/sleep on depression. However,

there was no statistically significant difference between the standardized coefficients of situation specificity and consequences, suggesting that psychological flexibility might play a full mediating role in the relationship between situation specificity and consequences on depression (Table 4).

To further investigate the mediating effect of psychological flexibility between fatigue and depression, the authors performed mediation analysis using the bootstrap method. The results are shown in Table 5. The authors found that psychological flexibility also played a partial mediating role in the relationship between fatigue severity, consequences and depression. The contribution of psychological flexibility accounted for 8.5% and 12.3%. However, there was no mediating effect of psychological flexibility in the relationship between situation specificity, rest/sleep and depression.

DISCUSSION

The rapid development of medical knowledge not only requires medical personnel to continuously strengthen their learning to meet the needs of medical services, but also requires medical personnel to perform administrative duties, such as effectively handling medical disputes. Research results show that the mental health of medical staff is lower than that of the general population [28]. Long-term low mental health and working conditions

Table 4. Effects of psychological flexibility and fatigue on depression in multivariate regression analyses in nurses, study conducted in 2015 in Henan Province, China

Variable	Model 1		Model 2		Model 3	
	β	p	β	p	β	p
Gender	0.029	0.416	0.024	0.462	0.030	0.345
Marital status	0.018	0.660	−0.002	0.962	0.007	0.837
Age	−0.091	0.377	−0.085	0.357	−0.049	0.587
Length of service (years)	0.122	0.232	0.091	0.320	0.064	0.472
Fatigue severity			0.391	<0.001	0.357	<0.001
Circumstances			0.022	0.636	0.039	0.381
Consequences			0.105	0.012	0.077	0.061
Rest/Sleep			−0.105	0.004	−0.084	0.020
Psychological flexibility					−0.211	<0.001
Adjusted R^2	−0.001		0.199		0.240	
ΔR^2	0.004	0.472	0.203	<0.001	0.042	<0.001

β – standardized coefficient.
Model 1 – gender, marital status, age, length of service were included; Model 2 – gender, marital status, age, length of service and 4 subscales of fatigue were included;
model 3 – gender, marital status, age, length of service, 4 subscales of fatigue and psychological flexibility were included.

Table 5. The mediating effect of psychological flexibility between fatigue and depression in nurses, study conducted in 2015, Henan Province, China

Variable	Psychological flexibility (a)	Fatigue (b)	Effect		
			total (c)	direct (c')	indirect (ab) (95% CI)
Fatigue severity	−0.918***	−0.312***	3.380***	3.094***	0.287 (0.150–0.441)
Circumstances	−0.192	−0.393***	2.142***	2.067***	0.075 (−0.128–0.280)
Consequences	−0.720***	−0.344***	2.021***	1.773***	0.248 (0.124–0.395)
Rest/Sleep	0.380*	−0.408***	0.150	0.305	−0.155 (−0.329–0.002)

a – the effect of the independent variable on mediating variable; b – the effect of mediating variable on depression; c – the total effect of the independent variable
on depression; c' – the direct effect of the independent variable on depression after the introduction of mediating variable; a × b – the mediating effect of mediating variable
between fatigue and depression.
* $p < 0.05$; *** $p < 0.001$.

can easily lead to low mood among medical staff, which predisposes medical staff to a variety of mental illnesses and dysfunctions, including depression, anxiety, sleep disorders, and fatigue [29].

Depression is characterized by bad mood, slow thinking, reduced and delayed language and movement, which will have a negative impact on work and life. High-intensity labor load, high exposure risk, and tense medical-patient relationship cause medical staff to be under great psycho-

logical pressure. Multiple studies show that health care workers are more depressed than the general population [30–32]. This study found that 51.8% of the nursing staff had depressive symptoms, which was at a high level. Previous studies showed that migrant workers with short working years have relatively insufficient occupational coping resources (such as occupational experience, social support, etc.) and were easily affected by the external environment, resulting in higher depression [33]. Howev-

er, the authors found that the nursing staff in this survey tended to become more depressed with the increase of working age. The reason might be various factors related to the nursing work environment, which needs to be further explored.

The present study found that fatigue severity, fatigue environment specificity, and fatigue outcome were positively associated with depressive tendencies. When the 4 dimensions of fatigue were included in the hierarchical regression analysis, the regression coefficients and models of the 2 dimensions were statistically significant, and the explained variance increased by 20.3%, indicating that fatigue has a greater predictive effect on depressive symptoms. Fatigue is a common symptom in people with depression. The co-occurrence of fatigue and depression is the result of a combination of factors, and when a patient's fatigue become worse, so does his or her depression [34]. The results of the follow-up study showed that the lifetime prevalence of depression in people with fatigue was 20.7%, while the prevalence of depression in people without fatigue was only 2.3% [35].

The authors' survey of fatigue severity showed that married nurses had higher fatigue severity scores than singles [36]. The reason might be that married people have to work and take care of their families, which is easy to cause fatigue [37]. The fatigue of newly recruited employees might be because they need to spend more time to adapt to the new working environment, learn professional skills hard, and have a high workload. However, the fatigue degree of older employees could be related to heavy burden of family life, low income, and boring working environment, resulting in a relatively heavy degree of fatigue. The length of service showed inconsistent results with age, and the fatigue severity of nursing staff in the serving ≥6 years was higher, indicating that the workload of nursing work became heavier with the professional ability. The emergency department is on call 24 h/day and should be ready to deal with various emergencies at

any time. The workload of internal medicine nursing staff is heavy, and the severity of fatigue is higher than that of other departments. Patients in the department of internal medicine have a relatively long course of diseases. During hospitalization, patients and their family members are prone to negative emotions such as discouragement and depression, and these negative emotions may affect nurses who have long-term close contact with patients to varying degrees. Then the psychological consequences of the fatigue of nurses in the internal medicine may be more serious.

The environmental specificity of fatigue reflects the sensitivity of individual fatigue to special situations. Nursing staff in the ≥30 years age group and ≥6 years working years group have relatively good healthcare ability, generally with more work experience and higher technical level. Therefore, in addition to facing the noisy physical environment of the hospital and the complex interpersonal relationships with patients, patients' families, doctors and other nurses, they also have to bear more work pressure and be in a state of high stress for a long time. And they are relatively older, have a slower metabolism, less stamina and recovery, and are therefore more prone to fatigue.

Fatigue response is used to measure whether fatigue is responsive to rest or sleep. With the rapid development of modern medicine, there are many types of nursing care, rapid changes and high density. Nurses with longer working experience who are skilled in business have to undertake more responsibilities, and are easily exhausted mentally and physically, resulting in poorer response to rest and sleep.

Job acceptance refers to setting aside psychological space for painful thoughts and feelings, and choosing a meaningful life based on values, rather than trying to avoid and confront them [38]. For nurses, job acceptance means being able to pursue personal goals and work effectively without being affected by personal annoyances, work mistakes, or emotional distress. Better job acceptance

helps nurses make better use of beneficial resources in the work environment, and the better the grasp of the job, the higher the job engagement [23,39]. Study showed mental fatigue indirectly affects nurses' negative effects through the mediating effects of psychological inflexibility. Interventions using acceptance and commitment therapy for mental fatigue and negative emotions are more effective [40]. A systematic review suggests that employee-oriented flexible work may have small beneficial effects on mental health [41]. The results of this study showed that job acceptance could alleviate the effect of fatigue on depressive symptoms. Nurses with higher job acceptance had a lower risk of depression, while those with lower job acceptance showed a stronger depressive symptom when faced with challenges in work. Better job acceptance is closely related to the individual's mental health and quality of life, and the quality of job acceptance has a significant impact on the psychological status of the professional population.

Hierarchical regression analysis found that when 4 variables of fatigue were included at the same time, job acceptance showed a mediating effect in the relationship between fatigue severity, consequences, responsiveness to rest/sleep and depressive symptoms. When the 4 dimensions of fatigue were included separately, the bootstrap method showed that the mediating effect of job acceptance in the relationship between fatigue severity, consequences of fatigue and depressive symptoms was statistically significant, and the effect was large. Fatigue severity is the main factor measured by the fatigue scale, therefore, fatigue-induced depressive symptoms can be effectively alleviated by increasing the work acceptance stock.

Limitations exist in this study. This survey was a cross-section study, the investigated factors may be accompanied rather than causal relationship. Further cohort studies are needed to determine the causal relationship. Convenience sampling may have some bias, and the results may not be able to be generalized to population.

CONCLUSIONS

To sum up, psychological flexibility plays a mediating role in the fatigue severity, consequences of fatigue and depressive symptoms of nurses. It is recommended that medical units could regularly hold mental health training courses, appropriately increase the cultural and sports activities of medical staff, and adjust the workload and work shift system accordingly. In addition, hospital managers should consider optimizing the allocation of human resources in the hospital, and gradually improving the treatment of nursing staff, so as to relieve the fatigue of nursing staff and relieve depression of nursing staff.

ACKNOWLEDGMENTS

Author contributions
Research concept: Yongcheng Yao
Research methodology: Jie Tang, Hongling Meng, Zhenzhen Li
Collecting material: Jie Tang, Yuping Li, Haixia Du, Zhenzhen Li
Statistical analysis: Yongcheng Yao, Hongling Meng
Interpretation of results: Yongcheng Yao, Yuping Li
References: Jie Tang, Haixia Du

REFERENCES

1. Liu Q, He H, Yang J, Feng X, Zhao F, Lyu J. Changes in the global burden of depression from 1990 to 2017: Findings from the Global Burden of Disease study. J Psychiatr Res. 2020;126:134-40. https://doi.org/10.1016/j.jpsychires.2019.08.002.

2. Mata DA, Ramos MA, Bansal N, Khan R, Guille C, Di Angelantonio E, et al. Prevalence of Depression and Depressive Symptoms Among Resident Physicians: A Systematic Review and Meta-analysis. JAMA. 2015;314(22):2373-83. https://doi.org/10.1001/jama.2015.15845.

3. Maharaj S, Lees T, Lal S. Prevalence and Risk Factors of Depression, Anxiety, and Stress in a Cohort of Australian Nurses. Int J Environ Res Public Health. 2018;16(1). https://doi.org/10.3390/ijerph16010061.

4. Melnyk BM, Orsolini L, Tan A, Arslanian-Engoren C, Melkus GD, Dunbar-Jacob J, et al. A National Study Links Nurses' Physical and Mental Health to Medical Errors and Perceived Worksite Wellness. J Occup Environ Med. 2018;60(2):126-31. https://doi.org/10.1097/JOM.0000000000001198.

5. Abraham A, Chaabna K, Doraiswamy S, Bhagat S, Sheikh J, Mamtani R, et al. Depression among healthcare workers in the Eastern Mediterranean Region: a systematic review and meta-analysis. Hum Resour Health. 2021;19(1):81. https://doi.org/10.1186/s12960-021-00628-6.

6. Yao YC, Zhao S, Gao X, An Z, Wang SY, Li HB, et al. General self-efficacy modifies the effect of stress on burnout in nurses with different personality types. Bmc Health Services Research. 2018;18. https://doi.org/10.1186/s12913-018-3478-y.

7. Yao Y, Zhao S, Zhang Y, Tang L, An Z, Lu L, et al. Job-related burnout is associated with brain neurotransmitter levels in Chinese medical workers: a cross-sectional study. J Int Med Res. 2018;46(8):3226-35. https://doi.org/10.1177/0300060518775003.

8. Burton A, Burgess C, Dean S, Koutsopoulou GZ, Hugh-Jones S. How Effective are Mindfulness-Based Interventions for Reducing Stress Among Healthcare Professionals? A Systematic Review and Meta-Analysis. Stress Health. 2017;33(1):3-13. https://doi.org/10.1002/smi.2673.

9. Mohr DC, Hart SL, Goldberg A. Effects of Treatment for Depression on Fatigue in Multiple Sclerosis. Psychosom Med. 2003;65(4):542-7. https://doi.org/10.1097/01.Psy.0000074757.11682.96.

10. Shen J, Hossain N, Streiner DL, Ravindran AV, Wang X, Deb P, et al. Excessive daytime sleepiness and fatigue in depressed patients and therapeutic response of a sedating antidepressant. J Affect Disord. 2011;134(1):421-6. https://doi.org/https://doi.org/10.1016/j.jad.2011.04.047.

11. Farragher JF, Polatajko HJ, Jassal SV. The Relationship Between Fatigue and Depression in Adults With End-Stage Renal Disease on Chronic In-Hospital Hemodialysis: A Scoping Review. J Pain Symptom Manag. 2017;53(4):783-803.e1. https://doi.org/10.1016/j.jpainsymman.2016.10.365.

12. Garg H, Bush S, Gappmaier E. Associations Between Fatigue and Disability, Functional Mobility, Depression, and Quality of Life in People with Multiple Sclerosis. Int J MS Care. 2016;18(2):71-7. https://doi.org/10.7224/1537-2073.2015-013.

13. Skorvanek M, Gdovinova Z, Rosenberger J, Ghorbani Saeedian R, Nagyova I, Groothoff JW, et al. The associations between fatigue, apathy, and depression in Parkinson's disease. Acta Neurol Scand. 2015;131(2):80-7. https://doi.org/10.1111/ane.12282.

14. Deng JG, Xia FU, Wang RQ, Sun J. Correlation between individual fatigue level and occupational stress in medical radiation workers. Occup Health. 2015;31(23):3213-6. https://doi.org/10.13329/j.cnki.zyyjk.2015.1109.

15. Finnes A, Ghaderi A, Dahl JA, Nager A, Enebrink P. Randomized Controlled Trial of Acceptance and Commitment Therapy and a Workplace Intervention for Sickness Absence Due to Mental Disorders. J Occup Health Psychol. 2017;24(1):198-212.

16. Ost LG. The efficacy of Acceptance and Commitment Therapy: an updated systematic review and meta-analysis. Behav Res Ther. 2014;61:105-21. https://doi.org/10.1016/j.brat.2014.07.018.

17. Hayes SC, Luoma JB, Bond FW, Masuda A, Lillis J. Acceptance and commitment therapy: model, processes and outcomes. Behav Res Ther. 2006;44(1):1-25. https://doi.org/10.1016/j.brat.2005.06.006.

18. Kato T. Impact of psychological inflexibility on depressive symptoms and sleep difficulty in a Japanese sample. Springerplus. 2016;5(1):712. https://doi.org/10.1186/s40064-016-2393-0.

19. Landi G, Pakenham KI, Crocetti E, Tossani E, Grandi S. The trajectories of anxiety and depression during the COVID-19 pandemic and the protective role of psychological

flexibility: A four-wave longitudinal study. J Affect Disorders. 2022;307:69-78. https://doi.org/10.1016/j.jad.2022.03.067.

20. Martínez-Rubio D, Martínez-Brotons C, Monreal-Bartolomé A, Barceló-Soler A, Campos D, Pérez-Aranda A, et al. Protective role of mindfulness, self-compassion and psychological flexibility on the burnout subtypes among psychology and nursing undergraduate students. J Adv Nurs. 2021;77(8):3398-411. https://doi.org/10.1111/jan.14870.

21. Cunxi Y, Changpeng S, Ping L, Wangzhong C. Study on the status and relationship between workplace violence and depression tendency among doctors in A-level hospitals of Guangzhou Province. Chin J Health Education. 2017; 33(04):325-9. https://doi.org/10.16168/j.cnki.issn.1002-99 82.2017.04.009.

22. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. Appl Psychol Meas. 1977;1(3):385-401. https://doi.org/10.1177/014662167700 100306.

23. Bond FW, Lloyd J, Guenole N. The work-related acceptance and action questionnaire (WAAQ): Initial psychometric findings and their implications for measuring psychological flexibility in specific contexts. J Occup Organiz Psychol. 2013;86(3):331-47. https://doi.org/10.1111/joop.12001.

24. Yongcheng Y, Haixia D, Yuping L, Shuyan C, Zhenzhen L, Hongling M. The reliability and validity of work-related acceptance and action questionnaire to evaluate the occupational adjustment of medical staff. PSY. 2022;17(04):1-3. https://doi.org/10.19738/j.cnki.psy.2022.04.001.

25. Schwartz JE, Jandorf L, Krupp LB. The measurement of fatigue: a new instrument. J Psychosom Res. 1993;37(7): 753-62. https://doi.org/10.1016/0022-3999(93)90104-n.

26. Friedman JH, Alves G, Hagell P, Marinus J, Marsh L, Martinez-Martin P, et al. Fatigue rating scales critique and recommendations by the Movement Disorders Society task force on rating scales for Parkinson's disease. Mov Dis. 2010; 25(7):805-22.

27. Qingqi L, Zongkui Z, Gengfeng N, Cuiying F. Mobile phone addiction and sleep quality in adolescents: Mediation

and moderation analyses. Acta Psychol Sin. 2017;49(12): 1524-36. https://doi.org/10.3724/SP.J.1041.2017.01524.

28. Yong-Juan JI, Zhong-Yu H, Xiang ZN, Kuang GF. Study on mental health status and its influencing factors among 551 medical staffs in Qingdao City. Chin J Health Educ. 2015; 31(06):577-80. https://doi.org/10.16168/j.cnki.issn.1002-9982.2015.06.013.

29. Balch CM, Freischlag JA, Shanafelt TD. Stress and burnout among surgeons: understanding and managing the syndrome and avoiding the adverse consequences. Archiv Surg. 2009;144(4):371-6.

30. Shen L-L, Lao L-M, Jiang S-F, Yang H, Ren L-M, Ying DG-C, et al. A survey of anxiety and depression symptoms among primary-care physicians in China. Int J Psychiatry Med. 2012;44(3):257-70.

31. Gupta S, Prasad AS, Dixit PK, Padmakumari P, Gupta S, Abhisheka K. Survey of prevalence of anxiety and depressive symptoms among 1124 healthcare workers during the coronavirus disease 2019 pandemic across India. Med J Armed Forces India. 2021;77:S404-S12.

32. Gao Y-Q, Pan B-C, Sun W, Wu H, Wang J-N, Wang L. Anxiety symptoms among Chinese nurses and the associated factors: a cross sectional study. BMC psychiatry. 2012;12(1):1-9.

33. Chun-yan L, Jin-ji Z, Xiao-jun L, Ju-cheng P, Tian-xiang Q, Zhan S. Female Labor Bao'an District of Occupational Stress on the Mental Health Status of Affected. Chin Prim Health Care. 2008;22(6):68-9. https://doi.org/10.3969/j.issn.1001-568X.2008.06.035.

34. Zhuang LI, Liu Y, Xin GE, Department SH. Relative factor analysis on anxiety and depression state of patients with chronic fatigue syndrome based on data mining. Chin J Gen Pract. 2018;16(02):204-6. https://doi.org/10.16766/j.cnki.issn.1674-4152.000057.

35. Addington AM, Gallo JJ, Ford DE, Eaton WW. Epidemiology of unexplained fatigue and major depression in the community: the Baltimore ECA follow-up, 1981-1994. Psychol Med. 2001;31(6):1037-44. https://doi.org/10.1017/s003329 1701004214.

36. Kunert KMSNRN, King MLPRNCNS, Kolkhorst FWP. Fatigue and Sleep Quality in Nurses. J Psychosoc Nursing Mental Health Serv. 2007;45(8):31-7.

37. Annink A, den Dulk L. Autonomy: the panacea for self-employed women's work-life balance? Community Work Family. 2012;15(4):383-402. https://doi.org/10.1080/13668 803.2012.723901.

38. Hayes, Steven C. Acceptance and Commitment Therapy, Relational Frame Theory, and the Third Wave of Behavioral and Cognitive Therapies – Republished Article. Behav Ther. 2016;47(6):869-85.

39. Clark DMT, Loxton NJ. Fear, psychological acceptance, job demands and employee work engagement: An integrative moderated meditation model. Pers Individ Diff. 2012;52(8):893-7.

40. Wang D, Xie X, Tian H, Wu T, Liu C, Huang K, et al. Mental fatigue and negative emotion among nurses during the COVID-19 pandemic. Curr Psychol. 2022;41(11):8123-31. https://doi.org/10.1007/s12144-022-03468-2.

41. Shiri R, Turunen J, Kausto J, Leino-Arjas P, Varje P, Vaananen A, et al. The Effect of Employee-Oriented Flexible Work on Mental Health: A Systematic Review. Healthcare (Basel). 2022;10(5). https://doi.org/10.3390/healthcare10050883.