

# Effects of job conditions, occupational stress, and emotional intelligence on chronic fatigue among Chinese nurses: a cross-sectional study

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**Purpose:** Nurses are undertaking considerable emotional and physical work, which may lead to unrecoverable fatigue. This study aimed to evaluate the level of chronic fatigue and explore its associated factors among Chinese nurses in the hope of providing scientific evidence for fatigue-reduction strategies.

**Methods:** This cross-sectional study was carried out in Liaoning Province, China in 2018. The study recruited 700 nurses and collected 566 effective respondents. Chronic fatigue, demographic factors, job conditions, and emotional intelligence were assessed through questionnaires. Chronic fatigue was assessed with the Fatigue Scale 11, occupational stress with the Effort–Reward Imbalance Questionnaire, and emotional intelligence with the Wong and Law Emotional Intelligence Scale. Hierarchical multiple regression was used to explore factors related to chronic fatigue and to test the moderating effect of emotional intelligence on the association between occupational stress and chronic fatigue. Simple slope analysis was conducted to visualize the interaction.

**Results:** The mean score of chronic fatigue among the Chinese nurses was 17.14±6.16. Being married, having long weekly work time, working night shifts, and discontent with the nurse–patient relationship were positively associated with chronic fatigue. Effort:reward ratio, overcommitment, and emotional intelligence were important factors related to chronic fatigue. Emotional intelligence played a moderating role in the relationship between the effort:reward ratio and chronic fatigue. When emotional intelligence was higher, the effect of the effort:reward ratio on chronic fatigue became weaker.

**Conclusion:** Most nurses surveyed in China might have relatively high levels of chronic fatigue. Our results highlight the importance of interventions on these factors for the reduction of fatigue among nurses in China. Providing more opportunities and support and developing emotional intelligence are crucial strategies to reduce chronic fatigue among nurses in China.

**Keywords:** chronic fatigue, occupational stress, emotional intelligence, nurses, moderating effect

## Introduction

Fatigue is a common condition, and 5%–20% of the general population is reported to suffer from it.<sup>1–3</sup> Fatigue is defined by the North American Nursing Diagnosis Association as a self-recognized state in which an individual experiences decreased labor ability because of physical and mental overwork and feels an overwhelming persistent sense of tiredness, weakness, and exhaustion that is not moderated by rest.<sup>4</sup> Several mental and physical consequences can result from fatigue, including

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mood changes, decreased work capability, physical pain, and diseases, which can lead to considerable economic loss due to decreased productivity and increased health-care expenditure.<sup>5</sup> Obviously, unlike burnout or compassion fatigue, which operate only at the psychological level, the fatigue that we are interested in is a combination of psychological and physical levels. Generally, fatigue is divided into acute fatigue and chronic fatigue. Acute fatigue is a temporary state, while chronic fatigue is often considered an illness or long-term condition.<sup>6</sup> In this study, our investigation focused on chronic fatigue.

Chronic fatigue can be common among nurses. It has been reported that the level of fatigue is considerably high among nurses.<sup>7</sup> Another study also reported moderate–high levels of acute fatigue and moderate levels of chronic fatigue among nurses.<sup>8</sup> As nurses are an essential workforce at hospitals, chronic fatigue among them can have substantial underlying impact, including job dissatisfaction, adverse health outcomes, memory loss, prolonged reaction time, and decreased decision-making abilities, which can make fatigued nurses more prone to medical errors and may affect the quality of patient care delivered.<sup>5,9</sup> In summary, the considerable impact of chronic fatigue on nurses and patients necessitates the investigation of chronic fatigue and its associated factors.

Previous studies on fatigue have suggested that it is associated with demographic factors and work conditions. Finsterer et al<sup>10</sup> reported that fatigue was influenced by age and sex, specifically older age and being female predisposing individuals to fatigue. Another study reported an association between higher education level and higher level of fatigue among nurses.<sup>11</sup> Chen et al<sup>8</sup> found that married nurses experienced higher level of fatigue compared to nurses with other marital status. As for work conditions, Piko<sup>12</sup> reported that long working hours and high frequency of night shifts had strongly positive associations with chronic fatigue among nurses. In addition, a previous study reported that difficulties in the nurse–patient relationship could induce adverse health outcomes, such as depressive symptoms among nurses.<sup>13</sup> Bültmann et al<sup>14</sup> suggested that relationships with others at work also played a major role in the development of fatigue, as specific psychosocial experiences can exacerbate mental fatigue. Therefore, challenges in the nurse–patient relationship might have a significant impact on chronic fatigue among Chinese nurses.

More importantly, under working conditions in China, higher stress at the workplace is commonly found among

nurses, with a positive relationship with fatigue.<sup>15,16</sup> The effort–reward imbalance (ERI) model can be a helpful tool in quantifying occupational stress.<sup>17</sup> According to the ERI model, job stress arises from an individual's interactions with the psychosocial work environment. The model has three core elements: extrinsic effort, reward, and overcommitment. Extrinsic effort represents external results of one's demands or obligations imposed on themselves. Reward mainly comprises esteem, salary, and career opportunities. Overcommitment is defined as a personality characteristic reflecting a strong desire to be approved and valued.<sup>17</sup> Imbalance between extrinsic efforts and rewards or high overcommitment will introduce occupational stress, which can trigger psychosomatic responses and bring about or aggravate fatigue.<sup>18,19</sup> As a result, occupational stress may be a key factor associated with chronic fatigue among nurses in China.

Increasing occupational stress and the constant need to express empathy when delivering patient care can result in potential difficulties in nurse–patient relationships. Emotional intelligence can be one of the resources utilized by nurses to cope with these emerging challenges. Emotional intelligence has been defined as the ability of individuals to understand the emotions of themselves or others and to identify and use this information to control their own thinking or behavior.<sup>20</sup> Generally, it is believed that utilizing emotional intelligence on the job can have impacts on occupational stress, burnout, work engagement, and interpersonal relationships.<sup>21,22</sup> Nurses who possess high emotional intelligence have also been shown to have good health and general well-being.<sup>23,24</sup> As such, emotional intelligence may be a crucial factor related to chronic fatigue at work. In addition, to our knowledge, emotional intelligence can regulate individual stress and reduce negative mood.<sup>25,26</sup> Sharma et al<sup>27</sup> reported emotional intelligence moderated the relationship between occupational stress and psychological health. Görgens-Ekermans et al<sup>28</sup> also indicated that emotional intelligence played a moderating role in the association between work stress and burnout. Therefore, emotional intelligence seems likely to be a moderator in the relationship between occupational stress and chronic fatigue among nurses in China. However, few studies have explored such associations, which necessitates our study.

In summary, the present study aims to explore associated factors of chronic fatigue among nurses in Liaoning Province of China and to examine whether emotional intelligence has a moderating effect in the relationship between occupational stress and chronic fatigue among them.

## Methods

### Ethics statement

The procedures of this study were reviewed and approved by the institutional review board of China Medical University. Written informed consent was obtained from each participant. All data collected from the subjects were kept anonymous and confidential to protect their privacy.

### Study design and data collection

This cross-sectional study was conducted in Liaoning Province, China in 2018. Participants were sampled through a two-stage method. First, Liaoning Province consists of five regions: eastern, western, southern, northern, and central. In each region, two tertiary hospitals with >500 beds were randomly selected, totaling ten large hospitals. A total of 70 nurses as volunteers were randomly selected in each sampled hospital, totaling 700 nurses. Nurses who had worked <1 year were excluded from this study. After informed consent had been obtained, a self-administered questionnaire, which needed about 15 minutes to complete, was distributed to each study subject. Finally, we collected 566 questionnaires, with an effective rate of 80.9%.

### Measurement of fatigue

The Fatigue Scale (FS) compiled by Chalder et al has been used and validated by a number of studies for measuring the level of chronic fatigue.<sup>29</sup> In our study, we used the Chinese mainland version of the scale (FS11), a translation of the original Chalder FS.<sup>30</sup> The FS11 survey comprises eleven questions, each of which has four options with a score of 0–3 (0 = less than usual to 3 = much more than usual), with a total score ranging from 0 to 33. Higher scores indicate a higher level of chronic fatigue. Its validity and reliability have been tested among the Chinese population by Jing et al.<sup>31</sup> Cronbach's  $\alpha$ -coefficient for the FS11 in this study was 0.724.

### Measurement of demographic characteristics

Four demographic characteristics were collected from a self-designed questionnaire: age, sex, marital status, and education. Age was collected as a continuous variable. Options for marital status included unmarried, married/cohabitating, and divorced/widow/separated. Education was divided into "junior college and below", and "college and above".

### Measurement of job conditions

Three job factors — weekly work time, night shifts, and the nurse–patient relationship — were assessed with three self-designed questions. Using the domestic working-hour standard in China as the cut point, weekly work time was divided into  $\leq 40$  hours/week and  $> 40$  hours/week. The night-shift question was yes/no. Nurse–patient relationships were assessed with the question "How often have you been dissatisfied with the nurse–patient relationship at work?", with five possible answers: never, rarely, sometimes, frequently, and always. The response was further classified into satisfaction (never), moderate dissatisfaction (rarely/sometimes), or high dissatisfaction (frequently/always).

### Measurement of occupational stress

Occupational stress was measured by the ERI Questionnaire. The ERI Questionnaire was originally designed by Siegrist in 1996, and was translated to Chinese by Li et al.<sup>32,33</sup> The ERI Questionnaire has been used widely by researchers and has demonstrated adequate reliability and validity among sampled populations in China.<sup>33,34</sup> The 23-item ERI Questionnaire measures extrinsic effort (six items), reward (eleven items), and overcommitment (six items). It uses a 5-point Likert scale for extrinsic effort and reward (1 = no stressful experiences to 5 = very distressed) and a 4-point Likert scale for overcommitment (1 = strongly disagree to 4 = strongly agree). Effort:reward ratio was calculated by dividing effort by reward and multiplied by 11/6 to correct for the item-number difference in the two dimensions. An effort:reward ratio  $> 1$  means high cost and low gain, reflecting a risk-imbalance condition. A higher effort:reward ratio and overcommitment indicate higher occupational stress. Reliability measured by Cronbach's  $\alpha$ -coefficient for extrinsic effort, reward, and overcommitment in this study were 0.866, 0.762, and 0.756, respectively.

### Measurement of emotional intelligence

Emotional intelligence was measured using the Wong and Law Emotional Intelligence Scale (WLEIS).<sup>35</sup> This scale has been translated into Chinese and shown to have adequate reliability and validity among individuals surveyed in China.<sup>36</sup> The WLEIS is a 16-item scale consisting of four dimensions: self-emotion appraisal, appraisal of other's emotions, regulation of emotion, and use of emotion. In this article, we focus on total emotional intelligence. The response format is a 7-point Likert scale, ranging from 0 = strongly disagree to 6 = strongly agree,

with higher scores indicating higher emotional intelligence. Cronbach's  $\alpha$ -coefficient for the total scale was 0.848.

## Statistical analyses

Mean fatigue scores in different categories of demographic and job-condition factors were tested by *t*-test or one-way ANOVA. Pearson correlation analysis was used to analyze correlations among age, occupational stress, emotional intelligence, and chronic fatigue. All variables related to fatigue in univariate analysis ( $P < 0.05$ ) were entered in the hierarchical multiple regression model, which was used to estimate the contribution of different factors to the level of chronic fatigue and to evaluate the moderating effect of emotional intelligence on the relationship between occupational stress and chronic fatigue. In the model, potential control variables were entered in step 1. Occupational stress and emotional intelligence were added in step 2. Finally, the product of occupational stress and emotional intelligence was added in step 3. The hypothesis of the moderating effect of emotional intelligence was supported if the interaction were significant. Simple slope analysis was conducted to visualize the interaction term. The variance inflation factor was used to estimate whether a regression coefficient had increased because of collinearity. In the present study, factor values  $< 10$  were taken as multicollinearity not being an issue in the estimate. All statistical analyses were performed with SPSS for Windows 17.0, with two-tailed  $P < 0.05$  considered statistically significant.

## Results

### Demographic characteristics and job conditions

The average score of chronic fatigue among the nurses surveyed was  $17.14 \pm 6.16$ . Results of univariate analyses between chronic fatigue and each factor of demographic characteristics and job conditions of study subjects are shown in Table 1. Nurses who responded to the questionnaires were aged  $34.35 \pm 8.95$  years, 68.6% were married, and 52.7% of them had an education level of college and above. The proportion of the nurses whose weekly work was  $> 40$  hours was 81.8%, 56.9% did night shifts, and 19.4% of felt high dissatisfaction with the nurse–patient relationship. Furthermore, except sex, all the variables — marital status, education, weekly work time, night shifts, and nurse–patient relationship — were significantly associated with chronic fatigue.

### Correlations among chronic fatigue, occupational stress, and emotional intelligence

Correlation coefficients between continuous variables are presented in Table 2. The level of chronic fatigue was positively correlated with effort:reward ratio and overcommitment and negatively correlated with emotional intelligence. Emotional intelligence was negatively correlated with effort:reward ratio.

### Associations of demographic characteristics, job conditions, occupational stress, and emotional intelligence with level of chronic fatigue by hierarchical multiple regression analyses

In hierarchical regression models, demographic variables (including age, marital status, and education) and job conditions (including weekly work hours, night shifts, and nurse–patient relationship) were entered in step 1. Occupational stress (namely effort:reward ratio and overcommitment) and emotional intelligence were added in step 2. The interaction of occupational stress and emotional intelligence was entered in step 3.

As shown in Table 3, in step 1 marital status, weekly work hours, night shifts, and nurse–patient relationship were factors related to chronic fatigue. The linear combination of these variables partially explained the variance in chronic fatigue (adjusted  $R^2 = 0.146$ ,  $\Delta R^2 = 0.156$ ;  $P < 0.01$ ). In step 2, effort:reward ratio was found to be significantly and positively related to chronic fatigue ( $\beta = 0.282$ ,  $P < 0.01$ ), while emotional intelligence was significantly and negatively associated with chronic fatigue ( $\beta = -0.267$ ,  $P < 0.01$ ). Effort:reward ratio and emotional intelligence had significant effects on chronic fatigue (adjusted  $R^2 = 0.297$ ,  $\Delta R^2 = 0.152$ ;  $P < 0.01$ ). In step 3, the effort:reward ratio  $\times$  emotional intelligence interaction was significantly and positively associated with chronic fatigue ( $\beta = 0.158$ ,  $P < 0.01$ ). Therefore, emotional intelligence played a moderating role in the relationship between effort:reward ratio and chronic fatigue. Simple slope analysis of the interaction is presented in Figure 1, which shows that the impact of effort:reward ratio on chronic fatigue was different in low (1 SD below mean,  $\beta = 0.444$ ;  $P < 0.001$ ), mean ( $\beta = 0.308$ ,  $P < 0.001$ ), and high (1 SD above mean,  $\beta = 0.172$ ;  $P < 0.001$ ) levels of emotional intelligence. When emotional intelligence was higher, the effect of effort:reward ratio on chronic fatigue became weaker.

**Table 1** Demographic characteristics and job conditions of study participants and univariate analysis of factors in relation to level of chronic fatigue (n=566)

Variable	n (%)	Chronic fatigue (mean $\pm$ SD)	P-value
<b>Sex</b>			0.931
Female	552 (97.5%)	17.00 $\pm$ 6.32	
Male	14 (2.4%)	17.14 $\pm$ 6.16	
<b>Marital status</b>			0.001
Unmarried	160 (28.3%)	15.58 $\pm$ 5.50	
Married/cohabitating	388 (68.6%)	17.75 $\pm$ 6.28	
Divorced/widow/separated	18 (3.1%)	18.00 $\pm$ 7.01	
<b>Education</b>			0.002
Junior college and below	268 (47.3%)	16.29 $\pm$ 6.23	
College and above	298 (52.7%)	17.90 $\pm$ 6.01	
<b>Weekly work time</b>			0.001
$\leq$ 40 hours	103 (18.2%)	15.24 $\pm$ 7.04	
>40 hours	463 (81.8%)	17.56 $\pm$ 5.88	
<b>Night shifts</b>			<0.001
No	244 (43.1%)	18.12 $\pm$ 5.91	
Yes	322 (56.9%)	15.85 $\pm$ 6.26	
<b>Dissatisfaction with nurse-patient relationship</b>			<0.001
Satisfaction	30 (5.3%)	12.57 $\pm$ 6.50	
Moderate dissatisfaction	426 (75.3%)	16.60 $\pm$ 5.72	
High dissatisfaction	110 (19.4%)	20.47 $\pm$ 6.33	

**Table 2** Correlation coefficients among continuous variables (n=566)

Variable	Mean $\pm$ SD	1	2	3	4
1. Chronic fatigue	17.14 $\pm$ 6.16				
2. Age	34.35 $\pm$ 8.95	-0.017			
3. Effort:reward ratio	1.07 $\pm$ 0.41	0.405**	-0.047		
4. Overcommitment	16.23 $\pm$ 3.09	0.337**	0.058	0.419**	
5. Emotional intelligence	60.25 $\pm$ 16.01	-0.359**	0.081	-0.186**	-0.019

Note: \*\* $p < 0.01$  (two-tailed).

As shown in Table 4, in step 2, after adjustment control variables, overcommitment was found to be significantly and positively related to chronic fatigue ( $\beta = 0.275$ ,  $P < 0.01$ ), while emotional intelligence was significantly and negatively associated with chronic fatigue ( $\beta = -0.321$ ,  $P < 0.01$ ). Overcommitment and emotional intelligence had significant effects on chronic fatigue (adjusted  $R^2 = 0.297$ ,  $\Delta R^2 = 0.152$ ;  $P < 0.01$ ). In step 3, the overcommitment  $\times$  emotional intelligence interaction term was not significantly associated with chronic fatigue ( $\beta = 0.019$ ,  $P > 0.05$ ). Therefore, emotional intelligence did not moderate the relationship between overcommitment and chronic fatigue.

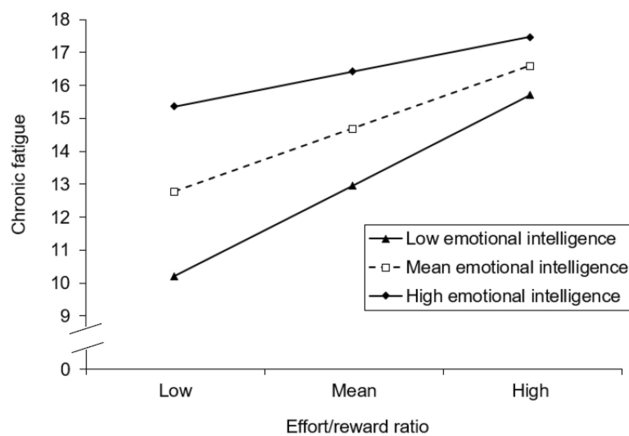
## Discussion

The results of this study showed that the average chronic fatigue score of nurses surveyed in China was 17.14  $\pm$  6.16. This score was higher than that reported by general communities and close to scores reported by patients.<sup>37-39</sup> This discrepancy may partly stem from the different survey conditions and administration used. However, this finding indicated that the chronic fatigue among nurses was a very noticeable issue. As such, finding the related factors of chronic fatigue and its relevant interventions is needed in reducing chronic fatigue among nurses.

**Table 3** Associations of demographic characteristics, job conditions, effort:reward ratio, and emotional intelligence with chronic fatigue (n=566)

Variable	Step 1	Step 2	Step 3
Age	-0.127*	-0.070	-0.078
Married vs unmarried	0.185**	0.148**	0.162**
Divorced/widow/separated vs unmarried	0.110*	0.079	0.077
Education	0.058	0.049	0.044
Weekly work time	0.094*	0.082*	0.072*
Night shifts	0.148**	0.124**	0.113**
Nurse-patient relationship	0.251**	0.107**	0.098*
Effort:reward ratio		0.282**	0.305**
Emotional intelligence		-0.267**	-0.281**
Effort:reward ratio × emotional intelligence			0.158**
F	14.748**	27.503**	27.591**
Adjusted R <sup>2</sup>	0.146	0.297	0.320
ΔR <sup>2</sup>	0.156	0.152	0.024

Notes: \*p<0.05; \*\*p<0.01 (two-tailed).



**Figure 1** Simple slope plot of the interaction between effort:reward ratio and emotional intelligence on chronic fatigue.

In our study, we found that married status was significantly associated with chronic fatigue, consistently with previous studies.<sup>8,9</sup> One possible reason might be that due to social and cultural norms, married nurses not only work hard in hospital to provide high-level service but also undertake housework, care for children, and support the elderly at home. Compared to nurses of other marital status, married nurses in China also need to spend considerable mental energy on working with relationships with husbands and parents-in-law. Therefore, this demand in balancing work-family time may contribute to additional fatigue.<sup>40</sup> As such, personal time with family should be one of the factors considered when arranging the shifts of nurses. A flexible working-schedule system can effectively solve this problem. However, it is not necessarily suitable for medical staff

in China, due to the heavy workload. Therefore, the relevant strategies need to be further studied.

We also found working-environment factors were importantly related to the level of chronic fatigue among nurses surveyed. Specifically, long weekly work time, night shifts, and dissatisfaction with the nurse-patient relationship were found to be significantly related to chronic fatigue, similarly to the findings of previous studies.<sup>8,41,42</sup> More than 80% of nurses surveyed in this study had weekly work time >40 hours, which is higher than the domestic standard in China. Work duration might be prolonged to meet the considerable number of patients and related workloads at hospitals. This prolongation of work time can leave nurses with less time to relax and recharge, which impedes the timely reduction of fatigue. As for night shifts, it is well accepted that working at night requires a lot of energy and is more likely to lead to the disorder of body rhythms, which may have a serious impact on fatigue of nurses.<sup>43</sup> In addition, we found nearly 20% of nurses were highly dissatisfied with the nurse-patient relationship. In fact, challenges in the nurse-patient relationship are on the rise in China.<sup>44</sup> At present, patients expect medical service of higher quality, while nurses are short-staffed to accommodate such expectations, which generates conflicts in the nurse-patient relationship. Furthermore, due to heavy workload, nurses have limited time to communicate with patients, which can also contribute to nurse-patient conflict, triggering negative emotions that contribute to perceived fatigue.<sup>44,45</sup> As a result, interventions might be needed to reduce the workload and work time of nurses, such as increasing the number of nurses that can share the workload and reducing night-shift frequency. In addition, hospital administrators should improve

**Table 4** Associations of demographic characteristics, job conditions, overcommitment, and emotional intelligence with chronic fatigue (n=566)

Variable	Step 1	Step 2	Step 3
Age	-0.127	-0.085	-0.084
Married vs unmarried	0.185**	0.134**	0.134**
Divorced/widow/separated vs unmarried	0.110	0.065	0.066
Education	0.058	0.073	0.074
Weekly work time	0.094*	0.077*	0.075*
Night shifts	0.148**	0.096*	0.097**
Nurse-patient relationship	0.251**	0.131**	0.130**
Overcommitment		0.275**	0.274**
Emotional intelligence		-0.319**	-0.321**
Overcommitment × emotional intelligence			0.019
F	14.748**	27.480**	24.728**
Adjusted R <sup>2</sup>	0.146	0.297	0.296
ΔR <sup>2</sup>	0.156	0.152	<0.001

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$  (two-tailed).

protocols to increase service efficiency, but also enhance nurses' communication and nursing skills, and organize some activities involving both nurses and patients to improve the relationship between them.

The results also revealed that effort:reward ratio and overcommitment were significantly and strongly associated with fatigue. Previous studies had similar findings, and suggested that the imbalance in effort:reward ratio and overcommitment can have direct effects on burnout.<sup>46,47</sup> Nurses in China are undertaking significant workloads while receiving somewhat disproportional reward, including relatively low pay, insufficient respect from patients, and limited opportunities of promotion and further education at the workplace. Imbalance between efforts and rewards can bring nurses a feeling of injustice and have a negative impact on their self-esteem and emotion.<sup>48</sup> The higher this imbalance, the more the emotional exhaustion and occupational stress, contributing to higher levels of fatigue.<sup>49,50</sup> On the other hand, to our knowledge, medical work requires a lot of responsibilities, which tends to produce high overcommitment among medical staff. The higher the level of overcommitment of nurses, the higher the possibility that they will devote themselves to work, which can trigger additional stress. Long-term accumulated psychological pressure will lead to fatigue. As one of the possible solutions, hospitals can establish more reward mechanisms for nurses, including higher compensation and opportunities for career advancement and further education, which could bolster their professional identity and job satisfaction to balance overcommitment.

In this study, emotional intelligence was found to have a negative association with the level of chronic fatigue. In addition, we also found that emotional intelligence moderated the association of effort:reward ratio with chronic fatigue, which partly confirmed our hypothesis. Results of the simple slope analysis showed that the higher the emotional intelligence, the weaker the effect of the effort:reward ratio on chronic fatigue. Emotional intelligence is one of the personal resources that can adjust psychological factors by regulating emotions and help release pressure proactively.<sup>25,51,52</sup> As a result, nurses who have high emotional intelligence may combat fatigue better, as they can regulate their negative emotions, relax themselves in timely fashion, and more easily recognize and manage the stress. This finding indicated that if occupational stressors are hard to reduce effectively, improving emotional intelligence may be a good way to minimize the negative impact of occupational stress on chronic fatigue. However, we did not find an interaction between overcommitment and emotional intelligence on chronic fatigue, which needs further research. Nevertheless, the significant effect of emotional intelligence on fatigue should be highlighted when formulating solutions for fatigue reduction. As emotional intelligence can be developed, hospitals can set up programs that facilitate the growth of nurses' emotional intelligence to improve their ability to respond to negative emotions and help alleviate fatigue, eg, introducing self-control and self-regulation strategies for nurses to release psychological pressure and to regulate emotions.<sup>53,54</sup>

Several limitations must be mentioned. The cross-sectional design of this study keeps us from drawing any conclusion of causal relationships between the factors examined and chronic fatigue. Future longitudinal studies are needed for exploration of causal relationships. Secondly, participations in this study were recruited from tertiary hospitals with >500 beds, and working conditions there might be different from small clinics and thus limit extrapolation to nurses who work in other type of clinical facilities. Thirdly, data were collected by the subjective measure of self-reported questionnaires from the subjects, which may be subject to recall bias and response bias. Our study tried to minimize such biases by using the FS11, ERI, and WLEIS, that have been well validated for application among subjects in China.

## Conclusion

In summary, based on this cross-sectional survey, our findings revealed that most nurses surveyed in China might have relatively high levels of chronic fatigue. Demographic factors, work conditions, occupational stress, and emotional intelligence were related to the development of chronic fatigue. Emotional intelligence moderated the association of effort:reward ratio with chronic fatigue. Our results highlight the importance of intervention on these factors for the reduction of fatigue among nurses in China. Providing more opportunities and support, adjusting job conditions, utilizing self-control, and developing emotional intelligence are crucial strategies to reduce chronic fatigue among nurses in China.

## Ethics approval and informed consent

The procedures of this study were reviewed and approved by the Institutional Review Board of China Medical University. Written informed consent was obtained from each participant. All data collected from the subjects was kept anonymous and confidential to protect the privacy of the study subjects.

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## Disclosure

The authors report no conflicts of interest in this work.

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