

# The effect of night shift on sleep quality and depressive symptoms among Chinese nurses

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**Purpose:** Night shift is associated with adverse physical and psychological health outcomes such as poor sleep quality and depressive symptoms. We aimed to compare sleep quality as well as depressive symptoms in nurses working night shifts to those working day shifts only and explore the association between sleep quality and depressive symptoms among nurses.

**Patients and methods:** Eight hundred sixty-five nurses were enrolled in the current study. Sleep quality and depressive symptoms among nurses were evaluated by the Pittsburgh Sleep Quality Index (PSQI) and Hospital Anxiety and Depressive Disorders Rating Scale (HADS), respectively.

**Results:** PSQI and HADS scores were both significantly higher in the nurses working night shifts ( $P < 0.05$ ) than in those working day shifts only. Besides, there was a positive correlation between PSQI and HADS scores. Binary logistic regression showed that night shift and poor sleep quality were independent risk factors of depressive symptoms among nurses.

**Conclusion:** Higher rates of depression among Chinese nurses working night shifts may be associated with poor sleep quality induced by night shift.

**Keywords:** nurse, depression, night shift, sleep

## Introduction

As a result of growing demand for quality of care, rising public expectations and economic constraints, nurses are continually under both acute and chronic workplace stressors which predispose them to vulnerability to psychological disorders such as depression.<sup>1</sup> In the United States, the prevalence of depressive symptoms is approximately twice as high among registered nurses in hospitals as in the general population.<sup>2</sup> Recently, China has reported a series of violent injuries to medical workers, which has attracted worldwide attention.<sup>3</sup> As revealed in a survey including 588 nurses in China, the rates of physically and nonphysically violent experiences were 7.8% and 71.9%, respectively,<sup>4</sup> which might bring additional psychological pressure to Chinese nurses. Therefore, early recognition of depressive symptoms among Chinese nurses is of great importance, which is an essential step in the prevention of adverse consequences to patients, nurses and health care organizations.<sup>5</sup>

Hospitals are institutions where service is given for 24 hours 7 days a week and nurses are largely locked into schedules including night shift.<sup>6</sup> Unfortunately, night shift may negatively impact work-life balance and social interactions, resulting in greater mental distress.<sup>7</sup> Moreover, previous studies have revealed that night shift is associated with an increased risk of depressive symptoms.<sup>8-10</sup>

Night shift is known to disturb the cortisol and melatonin rhythms,<sup>11</sup> which is tightly associated with sleep quality.<sup>12,13</sup> One of the most common complaints of night-shift

workers is a lack of adequate sleep during the day following a night shift.<sup>14,15</sup> A study revealed that nurses working night shifts had worse sleep quality that negatively impacted their health status.<sup>16</sup> Besides, sleep quality is also associated with depressive symptoms. As shown in an epidemiological study, sleep disturbances were reported in up to 90% of individuals with depressive symptoms.<sup>17</sup> Similarly, another study reported that shorter sleep duration across 6 months predicted depression severity in patients who developed an episode.<sup>18</sup>

The role of sleep quality in the association between night shift and disturbed physiological and psychological health status had been investigated in several previous studies.<sup>19,20</sup> However, none of the previous studies has ever explored the role of sleep quality in the association between night shift and depressive symptoms among nurses. Based on the close relationship among night shift, sleep quality and depressive symptoms, we hypothesize that poor sleep quality may play a role in the association between depressive symptoms and night shift among Chinese nurses. The objective of this study was to investigate 1) the association between depressive symptoms and night shift among nurses and 2) the association between depressive symptoms and sleep quality among nurses.

## Patients and methods

### Patients and study design

This cross-sectional study was implemented from June to October 2017 in Jinhua Municipal Central Hospital in Zhejiang Province (Southern China). One thousand two hundred eighty-eight nurses were invited to complete self-administered anonymous questionnaires and 423 nurses declined to take part in for no interest. Finally, 865 nurses agreed to participate and completed self-administered anonymous questionnaires. According to self-report, nurses working night shifts were those whose work shifts involved night work, which was defined by having a work schedule encompassing midnight. The most common start and end hour of the night shift was 11:00 pm and 8:00 am. Besides, day shifts were defined by having a work schedule during 8:00 am to 11:00 pm, which included the evening shifts.

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Research Ethics Committee in Jinhua Municipal Central Hospital. All the participants had read the purpose statement of the investigation and signed an informed consent.

### Clinical variables and assessments

In the study questionnaire, data on participants' sociodemographic variables and other clinically relevant variables were

collected. Information on clinical variables was collected using the following instrument:

Sleep quality of the patients was evaluated by Pittsburgh Sleep Quality Index (PSQI), which is a commonly used 19-item psychometrically validated measure of sleep quality and disturbances. It has a score range of 0–21, with scores  $\leq 5$  associated with good sleep quality and  $> 5$  associated with poor sleep quality.<sup>21</sup>

Depressive symptoms were measured using Hospital Anxiety and Depressive Disorders Rating Scale (HADS).<sup>22</sup> The items were scored on a 4-point scale, with responses ranging from 0 (not present) to 3 (considerable), with higher score indicating higher symptom levels. Participant with a score  $> 7$  was considered to have depressive symptoms.

### Statistical analysis

Baseline characteristics were compared using ANOVA for continuous variables and chi-squared test for categorical variables. Fisher's exact test was used for categorical variables in the cases where the assumptions underlying chi-squared test were not fulfilled.

Pearson correlation was performed for bivariate correlation between PSQI and HADS scores. The influence of night shift and sleep quality on depressive symptoms was estimated by binary logistic regression analysis. To control the effects of potential confounders, factors with  $P < 0.05$  in the univariate analysis between groups were included in the logistic regression analysis. The results were indicated as adjusted OR (95% CI). Statistical analysis was performed using SPSS 20.0 (SPSS Inc., Chicago, IL, USA). Two-tailed  $P$ -values  $< 0.05$  were considered statistically significant.

## Results

Among the 865 nurses, 353 (40.8%) were considered to have depressive symptoms. As shown in Table 1, compared to nurses working day shifts only, nurses working night shifts were younger, with lower job rank and marriage rate, higher PSQI and HADS scores, and longer working hours (all  $P < 0.05$ ). Besides, there was also a positive correlation between PSQI and HADS scores ( $r = 0.428$ ,  $P < 0.001$ ).

As shown in Table 2, with all nurses taken as a whole, depression symptoms' occurrence taken as a dependent variable, the logistic regression analysis demonstrated that night work was independently associated with the presence of depressive symptoms (OR, 1.832; 95% CI, 1.232–2.724,  $P = 0.003$ ), with the age, marriage status, work hours and job rank being controlled. Moreover, nurses with poor sleep quality were also at higher risk of depression (OR, 2.558; 95% CI, 1.704–3.839,  $P < 0.001$ ). In addition, marriage status

**Table 1** Demographic, lifestyle and clinical characteristics for two groups

Variables	Day shift (n=174)	Night shift (n=691)	P-value
Age (years), mean $\pm$ SD	32.49 $\pm$ 10.35	28.33 $\pm$ 5.76	<0.001
Sex			0.961
Male	4 (2.3%)	13 (1.9%)	
Female	170 (97.7%)	678 (98.1%)	
Height (cm), mean $\pm$ SD	159.06 $\pm$ 15.14	160.34 $\pm$ 6.36	0.274
Weight (kg), mean $\pm$ SD	55.30 $\pm$ 8.47	53.52 $\pm$ 8.62	0.015
Marital status, married	109 (62.6%)	319 (46.2%)	<0.001
Religion			0.639
Yes	20 (11.5%)	71 (10.3%)	
No	154 (88.5%)	620 (89.7%)	
Education			1.000
Technical nursing school or lower	1	7	
Junior college	172 (98.9%)	681 (98.6%)	
Bachelor degree or above	1 (1.1)	3 (1.4%)	
Job rank			<0.001
Intermediate or higher	73 (42.0%)	129 (18.7%)	
Elementary or less	101 (58.0%)	562 (81.3%)	
Work hours/week, mean $\pm$ SD	41.69 $\pm$ 16.66	56.26 $\pm$ 20.25	<0.001
PSQI	7.94 $\pm$ 3.77	8.72 $\pm$ 3.31	0.007
HADS	6.00 $\pm$ 3.48	7.25 $\pm$ 3.73	<0.001
Depression			0.001
Yes	51 (29.3%)	302 (43.7%)	
No	123 (70.7%)	389 (56.3%)	
Sleep quality			<0.001
Good sleep quality	52 (31.6%)	109 (15.8%)	
Poor sleep quality	122 (68.4%)	582 (84.2%)	

**Abbreviations:** HADS, Hospital Anxiety and Depressive Disorders Rating Scale; PSQI, Pittsburgh Sleep Quality Index.

was associated with depressive symptoms (OR, 1.751; 95% CI, 1.237–2.478,  $P=0.002$ ).

## Discussion

The main findings of this study were the following: 1) nurses working night shifts showed more depressive symptoms than those working day shifts only; 2) nurses with poorer sleep quality showed more depressive symptoms; 3) nurses working night shifts showed poorer sleep quality than those working day shifts only. Higher rates of depressive symptoms in nurses working night shifts may be associated with poorer sleep quality induced by night shift.

The prevalence of depressive symptoms among nurses in this study (40.8%) was within the range of rates reported

in previous studies in China,<sup>23,24</sup> which was higher than that reported in western countries such as France and the United States.<sup>25,26</sup> The relatively high prevalence of depressive symptoms among Chinese nurses may be due to heavy workload, rising public expectations and unsatisfactory nurse–patient relationship caused by medical disputes.<sup>27</sup>

The relationship among sleep, cognitive and mental health has been studied in other contexts. For instance, previous studies in workers had observed that shift work may lead to poor sleep quality and diseases such as diabetes and hypertension.<sup>28</sup> Besides, good sleep quality may increase cognitive skills and reduce depressive symptoms of workers aged over 45 years.<sup>29</sup> Moreover, several previous studies in different contexts found that shift work was associated with poor sleep quality, depressive symptoms and fatigue in nurses.<sup>30–33</sup> Consistent with previous studies, the present research found that nurses working night shifts showed poorer sleep quality and nearly 2-fold increased risk of depression than those working day shifts. The main contribution of this paper is to analyze the role of sleep quality and depressive symptoms among Chinese nurses, which can extend previous studies. The disturbed circadian rhythms induced by night shift may explain for the findings.<sup>34</sup> Several studies had also demonstrated that circadian rhythm

**Table 2** Binary logistic model of the clinical determinants of depressive symptoms among nurses

Variables	OR	95% CI	P-value
Night shift	1.832	1.232–2.724	0.003
Age			0.456
Marriage	1.751	1.237–2.478	0.002
Work hours/week			0.715
Job rank			0.817
Poor sleep quality	2.558	1.704–3.839	<0.001

disturbances were associated with sleep quality and depressive symptoms,<sup>30,35–37</sup> which may be attributable to abnormal patterns of cortisol secretion and disruption of social rhythms.<sup>38</sup> In addition, it had been reported that treatment of the disruption of circadian rhythms may improve depressive symptoms.<sup>39</sup>

The present study also found a positive correlation between poor sleep quality and depressive symptoms, which was in accord with earlier findings.<sup>40,41</sup> In addition, sleep quality in individuals with depressive symptoms could predict treatment outcomes. Several studies found that poor sleep quality predicted poor response to nonpharmacological and/or pharmacological treatments of depressive symptoms.<sup>42,43</sup> Based on the relationship among night shift, sleep quality and depressive symptoms, we may infer that the sleep quality may play a role in the association between night shift and depressive symptoms among Chinese nurses. The role of poor sleep quality in the association between night shift and depressive symptoms might be explained by the disturbance of the internal circadian rhythm or insufficient recovery due to sleep disorders.<sup>44</sup> Several clinical observations supported that the various expressions of mood disorders may result from circadian dysregulation.<sup>45</sup> For example, patients with depressive symptoms showed abnormalities in phase timing, with a phase-advanced elevation of nocturnal body temperature occurring over the 24-hour diurnal cycle. Besides, patients with depressive symptoms showed increased cortisol secretion and a phase advance in its rhythm,<sup>46</sup> whereas, in healthy individuals, maximal secretion of cortisol occurs in the morning, followed by a progressive reduction throughout the day until a nadir is reached in the evening. Moreover, previous studies in patients with depressive symptoms reported reductions in melatonin secretion and phase delays in the circadian rhythm of melatonin.<sup>47,48</sup> In addition, previous studies had also demonstrated that disruption of social rhythms was associated with depressive symptoms.<sup>38,49</sup>

However, conflicting findings have been noticed. In a study among Norwegian nurses, no significant differences were observed between night shift and depressive symptoms as well as sleepiness.<sup>50</sup> Inconsistencies in the existing literature might be explained by the difference in medical system, workload, work settings and work environments.

Several limitations of this study should be mentioned. First, owing to the cross-sectional nature of the present study, causal inference of the night shift with sleep quality and depressive symptoms cannot be confirmed. Future studies should adopt a longitudinal study design to confirm the causal relations among night shift, sleep quality and depressive symptoms. Despite the direction of causation, the fact that nurses working night shifts had greater risks

of poor sleep quality and depressive symptoms still poses a health concern about nurses working night shifts. Second, owing to the limitation of the questionnaire design, work schedules could only be classified into day vs night shifts, leaving other domains of shift work undetermined. Finally, nurses working night shifts were younger, had lower job rank and worked longer hours. These factors might impose some selection bias on the results, although we had adjusted for these potential confounders in the logistic regression analysis. Future research should improve the assessment of shift work patterns. Finally, aggression and violence among nurses were not measured.

## Conclusion

This study shows that higher rates of depressive symptoms in nurses working night shifts may be associated with poorer sleep quality induced by night shift. Considering previous studies in different contexts, the main contribution of this paper is to analyze the role of sleep quality and depressive symptoms among Chinese nurses. Further investigation may focus on a longitudinal study to confirm the causal relations among night shift, sleep quality and depressive symptoms.

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## Author contributions

FC, SN and CD designed the study and wrote the protocol; CD, HQ, QH, PH and XH conducted literature searches and provided summaries of previous research studies. JT, QX, HL and WR conducted the statistical analysis. CD and HQ wrote the first draft of the manuscript. All authors reviewed and approved the final version of the manuscript. All authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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