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Investigation of Sleep Quality of 150 First-Line Medical Staff Responding to COVID-19

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ABSTRACT

Objective: *Understanding the sleep quality of first-line medical staff responding to COVID-19 is of great significance in this special epidemic period.*

Methods: *A questionnaire was conducted via a WeChat working group to 150 first-line medical staff. All participants who felt that their sleep quality had declined were assessed using the Athens Insomnia Scale (AIS) voluntarily and anonymously, and further reported their preferred methods for improving sleep quality.*

Results: *1. A total of 38 participants reported their sleep quality was declined. Of these, 27 had AIS scores ≥ 6 (objective insomnia), and 11 had AIS scores ranging from 1 to 5 (subjective insomnia). Women exhibited a higher incidence of objective insomnia than men (25.8%,5.3%). Nurses exhibited a higher incidence of objective insomnia than doctors and technicians (25.3%,4.4%,7.7%). 2. Participants with objective insomnia had more obvious depression symptoms than those with subjective insomnia (6.00[P50],1.00[P50]). The influencing factors for objective insomnia included disease factors, time factors, work factors, rhythm disturbance, somatic factors and emotional factors. 3. 92.6% of participants with objective insomnia felt that relaxation was the best way to improve sleep quality.*

Conclusions: *The results revealed a high prevalence of objective insomnia in front-line medical staff against COVID-19, which was closely related to the characteristics of the COVID-19 epidemic. Relaxation techniques may be an appropriate method for improving sleep quality.*

Keywords

COVID-19, Medical staff, Sleep quality.

Introduction

Sleep disorders, a group of conditions including insufficient sleep duration, irregular timing of sleep, poor sleep quality, and sleepiness, are widespread in modern societies [1]. Sleep disorders are associated with autonomic dysfunction [2], impairment of cognitive abilities [3], lack of energy, and physical fatigue [4], leading to a decline in quality of life, impairments of occupational functioning [5], and increased risk of accidents [6].

An increasing number of studies have examined the sleep quality of medical staff who directly deliver healthcare and save lives. Previous studies have indicated that sleep disorders can increase medical occupational accidents, including drug administration

errors and the incorrect operation of medical equipment [6,7]. Scott et al. [8] reported that nurses who are fatigued because of poor sleep are more likely to make incorrect decisions that lead to decision regret. Therefore, it is important to implement strategies for reducing the risks arising from inadequate sleep [9]. A large number of studies have investigated the incidence and related factors of sleep disorders in medical staff. Bjorvatn et al. [10] reported that 70% of nurses working in intensive care units in Norway experience poor sleep. This rate is higher than that of the general Norwegian population. Shift work was negatively related to sleep quality. Dong et al. [11] reported that 63.9% of clinical nurses in general hospitals in Mainland China exhibited sleep disturbances, and general risk factors included female, working in the emergency department, and high night shift frequency. The researchers analyzed the correlations between occupational stress and sleep quality, reporting that high psychological demand, low job control, and low workplace social support were associated with the development of sleep disturbances. Lin et al. [12] reported that job stress was inversely related to sleep quality, which was directly related to self-perceived health status. Therefore, occupational stress also plays an important role in sleep disturbance among medical staff.

The COVID-19 epidemic is a public health emergency of international concern, owing to its rapid spread, extreme harm and complexity of pathogenesis [13]. Wuhan, the first city to be severely affected in the COVID-19 epidemic. Tens of thousands of medical staff have provided emergency assistance in Wuhan. Recently, several mental health surveys of medical staff working to treat COVID-19 have been reported. Approximately 50% of the medical staff at Nanfang Hospital, Southern Medical University exhibited depression, 44.7% exhibited anxiety, and 36.1% exhibited insomnia based on scores of the Insomnia Severity Index ≥ 8 [14]. Data from 32 regions across China also indicated that 42.3% of clinical first-line workers had insomnia. Further analysis revealed that subjective support and support utilization had protective effects on insomnia [15]. Zhu et al. [16] assessed the immediate psychological impact on health workers at Tongji Hospital in Wuhan, reporting that 24% exhibited anxiety and 33.5% exhibited psychological stress.

To date, there has been little research on sleep quality among first-line medical staff responding to COVID-19 in Wuhan city. The main purpose of our current research was to 1. investigate the incidence and severity of sleep disorders and related factors, 2. explore the most appropriate intervention methods. The current study was designed to provide data to support targeted interventions to improve the psychological health of frontline health workers.

Material and methods

Study participants

All participants met the following criteria: coming from 105 hospitals in Zhejiang Province, working on the clinical frontline at Tianyou Hospital (affiliated with the Wuhan University of Science and Technology), and self-isolating after finishing work in the same apartment hotel located 500 meters from Tianyou Hospital. The study was approved by the ethics committee of Tongde Hospital in Zhejiang Province. All participants provided informed consent.

Investigation method

Using the Questionnaire Star technology platform, we designed a questionnaire and distributed it to 150 medical staff using the WeChat app. Participants anonymously submitted completed questionnaires online. Participation was completely voluntary and participants received no payment for taking part in the study.

Questionnaire measures

The questionnaire comprised several questions and could be completed in 3 minutes. The following variables were assessed: General characteristics: sex, age, marital status, educational background, occupation, professional title, time spent dealing with the epidemic. (2) The Athens Insomnia Scale (AIS) [17] was used to assess the severity of sleep disorders. The AIS is an inventory consisting of eight items. The first five items assess nocturnal sleep problems (e.g., difficulty in sleep initiation, awakening during the night, early morning awakening), and the remaining three items assess daytime dysfunction caused by insomnia (e.g., overall functioning, sleepiness during the day). Responses were reported on a four-point scale ranging from 0 (no problem at all) to 3 (very serious problem). A total score of ≥ 6 on the eight AIS items indicates objective insomnia. (3) The Patient Health Questionnaire-9 (PHQ-9) depression self-assessment scale was used to assess depression symptoms. The PHQ-9 is a nine-item self-assessment scale rated on a four-point Likert scale; higher scores indicate more severe depression. A total score < 5 indicates no depression and a score ≥ 5 indicates depression: a score of 5–9 indicates mild depression, 10–14 indicates moderate depression, 15–19 indicates moderate and severe depression, and 20–27 indicates severe depression. (4) A simple self-designed questionnaire was used to assess related factors: disease factors (e.g., fear of disease), time factors (e.g., end time unknown), work factors (e.g., heavy work), rhythm disturbance (e.g., three or four-shift work), somatic factors (e.g., fatigue), emotional factors (e.g., anxiety, depression), decreased interpersonal communication (e.g., isolation from other personnel), family factors (e.g., complaints from family), and external factors (e.g., lack of protective equipment, inadequate management). Each item had four response options: "Disagree" (0 points) "Mildly Agree" (1 points), "Moderately Agree" (2 points) and "Fully Agree" (3 points). (5) We asked participants the question "What are your preferred methods for improving sleep disorders?", with five response items: relaxation method, subscribe to sleep information, psychological counseling, establishing an insomnia support group, and medical treatment. Participants selected "Yes" or "No" for each item.

Statistical methods

Data were exported from the Questionnaire Star platform and saved in Excel. SPSS 19.0 was used to establish a database for analysis. The χ^2 test was used to examine differences in the incidence of insomnia between people with different demographic characteristics. The H-Test was used to examine differences in emotional responses and influencing factors between participants

with objective and subjective insomnia. $P < 0.05$ was considered to indicate statistical significance.

Results

General demographic distribution of people with sleep disorders

A total of 38 (25%) participants felt their sleep quality was declined. There were 27 participants with AIS scores ≥ 6 (defined as objective insomnia), and 11 participants with AIS scores of 1–5 (defined as subjective insomnia). Women exhibited a higher incidence of objective insomnia than men (25.8% vs 5.3%, $\chi^2 = 10.105$, $P = 0.001$). Nurses exhibited the highest incidence of objective insomnia among nurses, doctors and technicians ($\chi2 = 8.503$, $P = 0.014$) (Table 1).

Differences between participants with objective insomnia and subjective insomnia

Participants with objective insomnia exhibited more nocturnal sleep problems (7.00 [P50] vs 3.00 [P50], $P < 0.001$) and more declined daytime dysfunction (2.00 [P50] vs 0.00 [P50], $P < 0.001$) than those with subjective insomnia. Participants with objective insomnia exhibited more severe depressive symptoms (6.00 [P50] vs 1.00 [P50], $P < 0.001$). The influencing factors for objective insomnia included disease factors, time factors, work factors, rhythm disturbance, somatic factors and emotional factors ($P < 0.05$).

Preferred methods for improving sleep among participants with objective insomnia

The most common preferred method to improve sleep among participants with insomnia was relaxation (92.6%). Approximately 26% of participants with objective insomnia took medication, and 22% felt that they needed psychological counseling.

Item		Total (n=150)	Objective insomnia (n=27)	χ^2	*P*
Gender				10.105	0.001
	male	57	3(5.3%)		
	female	93	24(25.8%)		
Age				1.927	0.382
20-30		30	7(23.3%)		
31-40		90	17(18.9%)		
>40		30	3(23.3%)		
Marriage				0.808	0.369
Unmarried		38	5(13.2%)		
Married		112	22(19.6%)		
Education				2.642	0.104
Undergraduate		130	26(20.0%)		
Master degree or above		20	1(5.0%)		
Occupation				8.503	0.014
Doctor		40	2(4.4%)		
Nurse Managerial and technical staff		97 13	24(25.3%) 1(7.7%)		
Title					
Primary		40	10(25.0%)	5.917	0.052
Intermediate		80	16(20.0%)		
Senior		30	1(3.3%)		

Table 1: General demographic distribution of participants with objective insomnia.

Item	Objective insomnia (n=27)	Subjective insomnia (n=11)	t/z	*P*
AIS				
Total	9.00 (8.00~13.00)	3.00 (1.25~4.00)	6.114	<0.01
Nocturnal sleep problems	7.00 (6.00~10.00)	3.00 (1.00~3.75)	6.182	<0.01
Daytime dysfunction	2.00 (2.00~3.00)	0 (0~1.00)	4.355	<0.01
PHQ-9	6.00 (4.00~8.00)	1.00 (0~2.50)	3.896	<0.01
Influence factor				
Disease factors	1.00 (0~2.00)	0 (0~0.75)	2.182	<0.05
Time factors	1.00 (1.00~1.75)	0 (0~0)	3.293	<0.01
Work factors	1.00 (1.00~2.00)	1.00 (0~1.00)	2.424	<0.05
Rhythm disturbance	2.00 (1.00~3.00)	1.00 (0.25~1.00)	2.679	<0.01
Somatic factors	1.00 (0~1.00)	0 (0~0.75)	2.501	<0.05
Emotional factors	1.00 (0.25~1.00)	0 (0~0.75)	2.725	<0.01
Communication	1.00 (0~1.00)	0 (0~1.00)	0.649	>0.05
Family factors	1.00 (1.00~2.00)	1.00 (0~1.75)	1.149	>0.05
External factors	1.00 (1.00~1.00)	0 (0~0.75)	4.113	<0.01

Table 2: Differences between participants with objective insomnia and subjective insomnia.

Item	Yes (n,%)	No(n,%)	χ^2	*P*
Selected methods			63.465	0.000
Relaxation method	25 (92.6%)	2 (7.4%)		
Subscribe to sleep information	3 (11.1%)	24 (88.9%)		
Psychological counseling	6 (22.2%)	21 (77.8%)		
Establish insomnia support group	1 (3.7%)	26 (96.3%)		
Take sleeping pills	7 (25.9%)	20 (74.1%)		

Table 3: Preferred methods of participants with objective insomnia.

Discussion

We investigated sleep quality among front-line medical staff responding to COVID-19. The results revealed that 25% of participants felt their sleep quality was declined, which was lower than the rate reported in previous studies of frontline healthcare workers responding to disease outbreaks. Su et al. [18] assessed the psychological status of nurses during the severe acute respiratory syndrome (SARS) outbreak in 2003, reporting that 37% of nurses in SARS intensive care units had insomnia. In addition, the mean AIS score in the current study was 9, indicating that sleep disorders were relatively mild. This result differs from the findings of Chen et al. [19], who reported a mean Pittsburgh Sleep Quality Index score of 12 points among 116 nursing staff during the SARS epidemic in Taiwan. This difference may be a result of the valuable experience gained from managing SARS, H1N1, and other major infectious diseases.

We found that gender affected the incidence of sleep disorders, female were more prone to insomnia than male. In accord with our finding, a recent review regarding gender differences in insomnia [20] reported that insomnia was approximately 1.5 times more common in female than in male, and sex hormones have been reported to influence sleep regulation and arousal, and possibly the outcomes of sleep conditions [21]. Lee [22] and Tang [23] reported that female participants who had worked in the SARS or H7N9 epidemics showed higher levels of post-traumatic stress disorder (PTSD) than male participants. Female are at higher risk of PTSD than male after exposure to similar traumatic events, and the association between sex and PTSD is independent of mechanism and injury event-related factors, such as perceived threat to life [24]. This gender difference may be a result of perception of stressors [25-27].

In the current study, nurses had a higher incidence of insomnia than doctors, suggesting that occupation may be an influencing factor for sleep disorders, as reported in a study by Kolo et al. [28]. In Kolo et al.'s study, the sleep health of tertiary healthcare workers was investigated, including doctors, nurses, administrative staff and other paramedics in Kano, Nigeria. The results revealed that 54.2% of participants had poor sleep, and poor sleep was most common among nurses. Sleep problems among nurses are increasingly recognized as a significant issue [29]. Li et al. [30] developed a model of work-related predictors of nurses' sleep quality. Shift work, job demands, exposure to hazards in work environments, chronic fatigue, and inter-shift recovery were identified as direct predictors of poor sleep among nurses. Occupational stress also impairs nurses' wellbeing, including their mental state and sleep quality [31]. Sleep disturbances among nurses are strongly associated with job difficulty, doctor-patient relationships, psychosomatic state and external environmental factors or events [32]. During the COVID-19 epidemic, nurses came into contact with patients more frequently than doctors while performing basic nursing and care tasks, which not only directly increases the risk of infection, but also causes more psychological stress because it involves witnessing the suffering of patients. In addition, nurses may experience more impact on the circadian rhythm than doctors because they more commonly engage in shift work. Taken together, these factors may have caused nurses to be more prone to sleep disorders than doctors.

The PHQ-9 scores of participants with objective insomnia were higher than those of participants with subjective insomnia, suggesting that those with objective insomnia were more likely to have negative emotional symptoms. Insomnia is a known risk factor for the incidence and severity of depression, recurrence of depressive episodes and even suicide [33-35]. In a 3-year longitudinal study, Nishitani et al. found that people with insomnia at baseline had an approximately seven-times greater risk of onset of depression, and the risk for onset of depression increased with the severity of insomnia. In a cross-sectional study, Lang et al. [36] attempted to examine the interaction between insomnia and depression by examining depression in patients who presented with and without insomnia. The results revealed that depression scale scores were higher for participants with insomnia compared with those without insomnia. Sleep problems have also been reported to increase the risk of depression during stress, with Kalmbach et al. [37] reporting that insomnia symptoms and cognitive intrusions predicted depression severity 1 year and 2 years later. Cognitive intrusions following stress create a depressogenic mindset, and nocturnal wakefulness may augment the effects of cognitive arousal on depression development. Poor sleepers may be particularly vulnerable to cognitive intrusions when having difficulty initiating sleep. Therefore, arousal threshold changes caused by insomnia may influence depression.

The factors affecting sleep are closely related to COVID-19 itself, and its direct consequences [38]. First, the high risk of infection of COVID-19, inadequate protection from contamination, and lack of targeted interventions may have caused an imbalance between the objective needs of medical staff and the ability to adapt to work, defined as occupational stress. This process is known to result in pre-sleep cognitive hyperarousal and emotion dysregulation, particularly among individuals with high sleep reactivity [39,40], and higher stress levels have been associated with lower subjective sleep quality, and daytime dysfunction [41]. Second, because all inpatients with COVID-19 require round-the-clock medical services, healthcare workers are required to undertake night-shift work, which inevitably causes disturbances to circadian rhythms and a decrease in sleep quality, as reported in previous studies [42,43]. Third, both overwork and wearing tight protective clothing can lead to chronic fatigue. Disturbance of circadian rhythms slows down the recovery of the body, and fatigue reduces

sleep quality.

The current results revealed that 92% of participants with insomnia reported utilizing relaxation methods, suggesting that participants felt the need for rapid recovery of their physical and mental health. This finding confirmed that emotional responses and fatigue coexisted in participants with insomnia, in accord with a previous report by Fagiolini [44]. This result provides important insight for informing the development of psychological interventions, including mind-body therapy for improving mental and physical health [45].

Several limitations of the current study should be noted. First, we examined a relatively small sample size, reducing the statistical power of the study. Second, because all respondents were from Tianyou Hospital (affiliated with the Wuhan University of Science and Technology), the results may not be representative of healthcare workers at other hospitals. Third, the survey was completed voluntarily by people with insomnia symptoms. Thus, we did not consider data from healthy individuals, and only compared participants with objective insomnia and those with subjective insomnia, potentially producing false negative results.

Conclusion

This study aimed to investigate sleep quality and associated factors among first-line medical staff responding to COVID-19. The findings showed that women and nurses exhibited a higher incidence of objective insomnia than men and doctors, which which was closely related to the characteristics of the COVID-19 epidemic. Relaxation techniques may be an appropriate method for improving sleep quality.

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