Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Sleep Medicine 74 (2020) 199–203

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Sleep disturbances among Chinese residents during the Coronavirus Disease 2019 outbreak and associated factors

Jing Wang [a, 1], Yanhong Gong [a, 1], Zhenyuan Chen [a], Jianxiong Wu [a], Jie Feng [a], Shijiao Yan [b, c], Chuanzhu Lv [c, d, e], Zuxun Lu [a], Ketao Mu [f, **], Xiaoxv Yin [a, *]

[a] Department of Social Medicine and Health Management, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, PR China
[b] School of Public Health, Hainan Medical University, Haikou, Hainan, China
[c] Key Laboratory of Emergency and Trauma of Ministry of Education, Hainan Medical University, Haikou, Hainan, China
[d] Department of Emergency, Hainan Clinical Research Center for Acute and Critical Diseases, The Second Affiliated Hospital of Hainan Medical University, Haikou, Hainan, China
[e] Emergency and Trauma College, Hainan Medical University, Haikou, Hainan, China
[f] Department of Radiology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

ARTICLE INFO

Article history:
Received 21 May 2020
Received in revised form
7 July 2020
Accepted 3 August 2020
Available online 7 August 2020

Keywords:
COVID-19
Sleep disturbances
Associated factors
Chinese residents

ABSTRACT

Objectives: Sleep status can affect the body's immune status and mental health. This study aims to investigate the sleep status of Chinese residents during the outbreak of Coronavirus Disease 2019 (COVID-19) and to evaluate its related risk factors.
Methods: This research carried out a cross-sectional survey in February 2020 (during the COVID-19 outbreak) to investigate the sleep status of residents nationwide in the form of an online questionnaire. Of the 8151 respondents, 6437 were eventually included in the analysis. Logistic regression is applied to analyze the associated factors affecting residents' sleep quality.
Results: During the COVID-19 outbreak, the incidence of sleep disturbances in residents was 17.65%. Increased risk of sleep disturbances was found to be associated with older age, female gender, and poor self-reported health status. Moreover, the odds ratios (ORs) were 1.42 (95% CI: 1.1–2.64), 1.35 (95% CI: 1.16–1.59), 5.59 (95% CI: 4.32–7.23), respectively. Those residents who believed COVID-19 had caused a high number of deaths or who thought COVID-19 was not easy to cure were more likely to experience sleep disorders, and the ORs were 1.73 (95% CI: 1.43–2.09), 1.57 (95% CI: 1.29–1.91), respectively. Regular exercise was a protective factor for sleep disturbances, OR = 0.77 (95% CI: 0.63–0.93).
Conclusions: During the outbreak of COVID-19, nearly one-fifth of participants had sleep disorders. It is necessary to pay more attention to people at high risk for sleep disturbances during the outbreak, adopt effective risk communication methods, enhance residents' rational understanding of COVID-19, and develop practical indoor exercise programs for general public to improve sleep quality.

1. Introduction

The 2019 novel Coronavirus Disease (COVID-19) pandemic poses a serious threat to global health [1,2]. To control the spread of the epidemic, countries around the world have adopted a series of effective measures, such as city lockdowns, home quarantine and production suspension [3,4]. These measures have achieved conspicuous results. However, these measures inevitably bring inconvenience to residents' lives, which changes their lifestyles and further affects their health.

Sleep is an essential part of our daily life and a significant predictor of residents' health [5]. Poor sleep status has a negative impact on residents' physical and mental health, and good sleep quality can enhance the body's immune defense [6]. Currently, many studies and surveys have confirmed that residents' sleep quality can be affected during the outbreak of emergent epidemics.

* Corresponding author. Department of Social Medicine and Health Management, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, No. 13 Hangkong Road, Wuhan 430030, China. Fax: +86 027 83692396.
** Corresponding author. Department of Radiology, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Jie Fang Avenue 1095, Wuhan 430030, China. Fax: +86 027 83662802.
E-mail addresses: muketao@163.com (K. Mu), yxx@hust.edu.cn (X. Yin).
[1] Contributed equally to this manuscript.

https://doi.org/10.1016/j.sleep.2020.08.002
1389-9457/

For example, a study showed that an outbreak of the Middle East Respiratory Syndrome, which occurred in Korea in 2015, had a great impact on the sleep of medical staff [7]. In the same year, a cross-sectional study conducted in Nigeria found that the most common psychological distress experienced by survivors and their relatives during the Ebola outbreak was lack of sleep due to worrying about the epidemic (33.3%; 39/117) [8]. A longitudinal study, which was conducted during the SARS outbreak in Taiwan province, China, showed that nurses had poor sleep quality [9]. Based on the above research evidence, we have reason to speculate that the sleep condition of the public may also be affected during COVID-19 outbreak. Before the outbreak, studies had shown that sleep was related to physiological, psychological factors and lifestyle. For instance, a previous multi-center cross-sectional study from the World Health Organization focused on the prevalence of sleep problem across eight countries in the continents of Africa and Asia, which investigated 43,935 people, found that the incidence of sleep problems varies by age and gender [10]. Another study, which surveyed 6284 Chinese college students, found that perceived stress, alcohol consumption and lack of exercise had a negative impact on sleep quality [11]. However, in the context of the current global COVID-19 epidemic, little research has been conducted on the sleep status of general public. Existing studies mainly focused on medical staff, and the sample sizes were relatively small [12]. Research on screening for sleep disturbances among public and its risk factors is scarce.

This study aims to conduct a cross-sectional survey to investigate the sleep status of Chinese residents during the outbreak of COVID-19, and determine the related risk factors, thereby providing scientific evidence for improving sleep quality of residents during the epidemic.

2. Methods

2.1. Ethical statement

This study was approved by the Medical Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology. All the respondents' participation was voluntary and informed consent was obtained.

2.2. Research design

This research was a web-based cross-sectional study. From February 4 to February 18, 2020 (during the outbreak of COVID-19), 80 undergraduates were recruited as investigators to conduct online questionnaire survey in the communities where their family lived. The target respondents were Chinese residents over 18 years old. The questionnaire link was sent to community residents through social networks, who submitted the questionnaire online anonymously after completing it. The survey content included questions on general demographic characteristics, perception of COVID-19, self-reported health status and sleep quality. Each investigator was recommended to cover 100 residents. The final total number of respondents was 8151. The number of respondents in Hubei (the epidemic area) and other regions were 2109 and 6,042, respectively.

2.3. Measurement indicators

The Pittsburgh Sleep Quality Index (PSQI) was used in the present study to evaluate the sleep status. This scale consists of seven dimensions and 18 items. It evaluates multiple dimensions of sleep over a one-month period. Eighteen self-evaluation questions generate seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. Each component is scored according to the levels 0–3. The accumulative score of each component is the total score of the PSQI. Total scores thus ranged from 0 to 21, where the higher the score, the worse the sleep quality. This study set seven points as the critical score to calculate the incidence of sleep disturbances [13].

In our study, self-reported economic status was surveyed using a question, “What do you think of your current financial situation?” with four response options, “very bad”, “bad”, “fair”, and “good”. The self-perceived physical health was measured using a single question, “What do you think of your current status of health?” with three response options, “good”, “fair”, and “bad”. The exercise status of residents during the COVID-19 outbreak was assessed by the question, “How often do you currently exercise per week? (more than 30 min at a time, eg, yoga, aerobic dance, etc.)” with three response options, “basically no or very little exercise”, “once or twice a week”, and “three times or more per week”.

The following two questions were set to investigate the residents' perception of COVID-19. This research evaluated residents' perception of COVID-19's fatality risk by the question, “What do you think of the death toll of COVID-19?” with two response options, “High” and “Low,” and residents' perception of COVID-19's treatment difficulty was evaluated by the question, “How do you rate the treatment difficulty of COVID-19?” with four options, Easy, Neither easy nor difficult, Moderately difficult, and Very difficult.

2.4. Statistical analysis

Statistical analysis was performed using SAS version 9.2. Descriptive statistical analyses were reported as frequencies and percentages. Chi-square tests were conducted to compare the incidence of sleep disturbances between groups. Multivariable logistic regression analysis was used to analyze the associated factors of sleep disorder. Adjusted odd ratios (ORs) and 95% confidence intervals (CIs) for each variable were calculated. For all comparisons, differences were tested using two-tailed tests and p-values less than 0.05 were considered statistically significant.

3. Results

Table 1 presents participants' characteristics. Of the 8151 completed questionnaires, 1714 were discarded because of too many missing data, irregularly filling or obvious logical errors. Finally, 6437 eligible questionnaires remained, and the effective rate of the questionnaire was 79.0%. The mean age of the 6437 residents was 31.40 (SD = 13.49). More than half of the participants were female (56.13%) and 55.85% of the participants had a bachelor's or higher degree. There were 55.48% of the participants reported good health. Of the 6437 participants, 17.23% considered perceived deaths of COVID-19 to be high, and 15.01% and 5.83% of participants thought that the treatment of COVID-19 was difficult and very difficult, respectively.

The average PSQI score was 4.85 ± 3.11, including 1136 participants with a PSQI >7, accounting for 17.65%. Table 1 shows that sleep disturbances were statistically related to age, education level, marital status, self-reported economic status, self-perceived physical health, exercise, perceived death of COVID-19 and perceived difficulty of COVID-19 treatment ($P < 0.05$). There were no significant differences in sleep disturbances among participants in terms of region and gender. The main symptoms of the 1136 residents with sleep disturbances were “cannot get to sleep within 30 min” (1026, 90.32%) and “wake up in the middle of the night or early morning” (848, 74.65%) (Table 3).

Table 2 demonstrates the factors contributing to the occurrence of 6437 residents' sleep disturbances surveyed in 2020. The result

Table 1
Descriptive statistics for the characteristics and associations with sleep disturbances of the participants.

Variables	All Participants		Participants with PSQI>7		X^2	*P*
	n	%	*n*	%		
Total	6437	100.00	1136	17.65		
Region					1.723	0.189
Other regions	4791	74.43	828	17.28		
Hubei province	1646	25.57	308	18.71		
Age					34.712	<0.0001
<30	3550	55.15	556	15.66		
30~39	1040	16.16	193	18.56		
40~49	1066	16.56	197	18.48		
≧50	781	12.13	190	24.33		
Gender					0.008	0.928
Male	2824	43.87	497	17.60		
Female	3613	56.13	639	17.69		
Education level					25.611	<0.0001
Junior middle school or below	832	12.93	174	20.91		
Senior middle school	941	14.62	190	20.19		
Associate degree	1069	16.61	214	20.02		
Bachelor degree or higher	3595	55.85	558	15.52		
Marital status					17.855	<0.0001
Unmarried/divorced/separated	3927	61.01	630	16.04		
Married/cohabitation	2510	38.99	506	20.16		
Self-reported economic status					23.897	<0.0001
Very bad	475	7.38	107	22.53		
Bad	883	13.72	193	21.86		
Fair	3873	60.17	645	16.65		
Good	1206	18.74	191	15.84		
Self-perceived physical health					320.554	<0.0001
Good	3571	55.48	405	11.34		
Fair	2535	39.38	581	22.92		
Bad	331	5.14	150	45.32		
Physical exercise					22.797	<0.0001
No	3020	46.92	604	20.00		
1~2 times/week	2077	32.27	335	16.13		
3 times or more/week	1340	20.82	197	14.70		
Perceived death of COVID-19					76.895	<0.0001
Low	5328	82.77	839	15.75		
High	1109	17.23	297	26.78		
Perceived difficulty of treatment					44.512	<0.0001
Easy	3606	56.02	545	15.11		
Fair	1490	23.15	282	18.93		
Difficult	966	15.01	224	23.19		
Very difficult	375	5.83	85	22.67		

Note: *P* values are associated with Chi-square tests.
PSQI= The Pittsburgh Sleep Quality Index.
COVID-19 = Coronavirus Disease 2019.

of a multifactor logistic regression analysis showed that those participants who were older (OR = 1.42, 95% CI: 1.1–2.64), who were female (OR = 1.35, 95% CI: 1.16–1.59); who reported fair (OR = 2.26, 95% CI: 1.94–2.63) or bad (OR = 5.59, 95% CI: 4.32–7.23) health, who believed COVID-19 had caused a high number of deaths (OR = 1.73, 95% CI: 1.43–2.09), who thought COVID-19 was not easy to cure (Fair, OR = 1.32, 95% CI: 1.11–1.57; Difficult, OR = 1.57, 95% CI: 1.29–1.91; Very difficult, OR = 1.34, 95% CI: 1.01–1.79) were more likely to experience sleep disorders. In addition, compared with those who do little or no exercise, people who exercised regularly every week were less likely to experience sleep disturbances (OR = 0.77, 95% CI: 0.63–0.93).

4. Discussion

To the best of our knowledge, this study is the first large-scale investigation to explore the prevalence and associated factors of sleep disorders in Chinese residents during the epidemic of COVID-19. The results of this study showed that during the outbreak of COVID-19, 17.7% of the Chinese residents had poor sleep quality. Residents who reported poor physical health, who believed that current situation of the epidemic was serious had a higher risk of experiencing sleep disturbances. Regular exercise was a protective factor of sleep quality. The results of this study provide data support for knowing the potential factors of sleep disorders among residents during the outbreak of COVID-19, and for helping to implement targeted interventions.

In this study, nearly one-fifth of participants had sleep disorders (17.7%). Prior to the COVID-19 outbreak, many studies on sleep quality of Chinese residents have been reported. For example, an epidemiological survey conducted in Tianjin in 2019 showed that 13.2% of adult residents had sleep disorders [14]. Surveys conducted in Xuzhou City and Liaoning Province in 2013 showed that the incidence of sleep disturbances was 8.96% and 11.59%, respectively [15,16]. Although the incidence of sleep disorders in this study is higher than that reported in the above studies, it is difficult to directly compare with the above results due to the changes in the study population. To some extent, this result indicates that emergent infectious diseases have a negative impact on sleep quality of Chinese residents. Previous studies demonstrated that emergency public health incidents could increase anxiety, depression and stress levels in general population and these negative emotions would have an influence on sleep quality [17–21].

Table 2
Multifactor logistic regression analysis of sleep disturbances with mutually adjusted odds ratios and 95% confidence intervals.

Variables	Estimate	SE	OR (95% CI)
Intercept	−3.4384	0.2973	
Area (Ref[a]: other provinces)			
Hubei province	0.0405	0.0776	1.04 (0.89–1.21)
Age (Ref: <30)			
30~39	0.0794	0.1121	1.083 (0.869–1.349)
40~49	−0.0154	0.1248	1.258 (0.77–1.26)
≧50	0.3479	0.1275	1.42 (1.1–2.64)**
Gender (Ref = male)			
Female	0.3023	0.0814	1.35 (1.16–1.59)***
Education level (Ref = junior middle school or below)			
Senior middle school	0.1231	0.1245	1.13 (0.89–1.44)
Associate degree	0.1891	0.1246	1.21 (0.95–1.54)
Bachelor degree or higher	−0.0352	0.1119	0.97 (0.78–1.2)
Marital status (Ref = unmarried/divorced/ separated)			
Married/cohabitation	0.1265	0.1015	1.14 (0.93–1.39)
Self-reported economic status (Ref = very bad)			
Bad	−0.0446	0.1444	0.96 (0.72–1.27)
Fair	−0.2036	0.1286	0.82 (0.63–1.05)
Good	0.0215	0.1535	1.02 (0.76–1.38)
Self-perceived physical health (Ref = good)			
Fair	0.8155	0.0770	2.26 (1.94–2.63)***
Bad	1.7206	0.1314	5.59 (4.32–7.23)***
Physical exercise(Ref = no)			
1~2 times/week	−0.1111	0.0797	0.9 (0.77–1.05)
3 times or more/week	−0.2666	0.0971	0.77 (0.63–0.93)**
Perceived death of COVID-19 (Ref = low)			
High	0.5479	0.0956	1.73 (1.43–2.09)***
Perceived difficulty of treatment (Ref = easy)			
Fair	0.2758	0.0893	1.32 (1.11–1.57)**
Difficult	0.4503	0.1002	1.57 (1.29–1.91)***
Very difficult	0.2955	0.1464	1.34 (1.01–1.79)*

Note: [a]Ref is reference.
*P < 0.05.
**P < 0.01.
***P < 0.0001(two-tailed test).

This study found that the elderly or female residents were more likely to experience sleep disorders. These findings are consistent with previous extensive epidemiological studies, which have shown that the incidence of sleep disorders increased with age [10,22], and women had worse sleep quality than men [10,23,24]. In addition, this study found that self-perceived health condition was an important factor affecting residents' sleep quality during the COVID-19 outbreak. Residents with self-perceived poor health had a significantly increased risk of experiencing sleep disorders. This finding suggests that during the epidemic, special attention should be paid to those who were more concerned about being infected due to their self-perceived poor health condition. This group of people is prone to negative emotions such as anxiety and depression [17–20,25], which can lead to further sleep problems [21]. In addition, due to strict quarantine measures during the epidemic [3,26], residents were facing problems of inconvenience to seek medical treatment, which would aggravate their concern about being unable to seek medical treatment in time when they were sick, thus exacerbating negative emotions of people who were in poor health and affecting their sleep quality. It suggests that although quarantine measures are effective for controlling the spread of major infectious diseases during outbreak, the basic health service needs of residents should also be guaranteed.

Table 3
Main symptoms of the residents with sleep disturbances (***n*** = 1136).

Symptoms	*n*	%
Cannot get to sleep within 30 min	1026	90.32
Wake up in the middle of the night or early morning	848	74.65
Have to get up to use the bathroom	739	65.05
Cannot breathe comfortably	497	43.75
Cough or snore loudly	614	54.05
Feel too cold	758	66.73
Feel too hot	533	46.92
Had bad dreams	652	57.39
Have pain	545	47.98
Other reasons	717	63.12

This study reconfirmed protective effects of exercise on residents' sleep quality during the COVID-19 epidemic. Previous studies have analyzed protective mechanisms of exercise on sleep conditions in different populations [27–29]. To contain the outbreak and spread of the disease, China adopted strict preventive and control measures such as isolation of close contacts and city lockdowns during the outbreak [3,4], which will inevitably restrict travels and outdoor exercise of Chinese residents. Therefore, in official epidemic prevention and control propaganda, it is supposed to increase suggestions on scientific and reasonable exercise for individuals, including the location, frequency and intensity of physical exercise, so as to assist the public in choosing appropriate indoor exercise to improve their sleep conditions.

Additionally, this study found that residents' awareness of severity of the epidemic was associated with their sleep quality. Residents who perceive a high death risk and treatment difficulty of the COVID-19 have an increased risk of experiencing sleep disorders, which is consistent with earlier study results. Moldofsky et al. [30], confirmed that sleep disorders experienced by SARS survivors were caused by factors such as worry and uncertainty about the epidemic situation. It suggests that government should provide accurate epidemic information during the outbreak to reduce negative effects of rumors, and to alleviate residents' worries about difficulties of controlling the epidemic. It is supposed to adopt appropriate risk communication methods, and use various forms of publicity and education channels, such as establishment of epidemic expert forums and consulting platforms, which could publicize and explain the disease hazards to the public, emphasize the curability, improve public knowledge about the disease, help the public to understand the situation of COVID-19 rationally, and guide residents to take effective prevention and control measures, thereby reducing panic and anxiety caused by residents' uncertainty and lack of knowledge.

There are several limitations in this study. First, this study is a cross-sectional study, thus we cannot establish a causal relationship between sleep disorders and related risk factors. Second, due to the influence of the epidemic, it is not appropriate to conduct face-to-face investigations. Therefore, an online questionnaire was used to conduct the survey, resulting in more young people and highly educated people who were better at using mobile phones among the respondents, which may underestimate the incidence of sleep disorders. In addition to the factors investigated in this study, there are other related factors that may affect sleep (eg, caffeine intake [31], obesity [32], chronic diseases [33] etc.). Considering the patience of residents in filling in questionnaires and the richness of questionnaire contents, we did not investigate too many related influencing factors in order to ensure the highest quality of questionnaire filling, which led to the shortcoming of this study.

5. Conclusion

This research provided scientific evidence for knowing the sleep quality of Chinese residents during the COVID-19 outbreak and its associated factors by administering a nationwide cross-sectional survey. This study showed that nearly one-fifth of participants

had poor sleep quality during COVID-19 outbreak. It is thus necessary to pay more attention to the elderly and people with poor health conditions. Practical indoor exercise programs should be designed for general public, which could improve their sleep quality. Moreover, during an epidemic outbreak, the government should adopt appropriate risk communication methods, expand publicity and education, and enhance residents' rational understanding of COVID-19, so as to relieve psychological pressure and alleviate residents' sleep problems.

Data statement

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

Funding

This study was supported by the Fundamental Research Funds for the Central Universities (No. 2020kfyXGYJ073), Huazhong University of Science and Technology. The funding resource had no role in study design; data collection, analysis and interpretation of data; writing of the report; or in the decision to submit the article for publication.

CRediT authorship contribution statement

Jing Wang: Conceptualization, Methodology, Investigation, Software, Formal analysis, Writing - original draft. **Yanhong Gong:** Conceptualization, Methodology, Software, Formal analysis, Data curation, Writing - review & editing. **Zhenyuan Chen:** Methodology, Investigation, Software, Formal analysis. **Jianxiong Wu:** Software, Investigation, Data curation. **Jie Feng:** Software, Investigation, Data curation. **Shijiao Yan:** Investigation, Data curation. **Chuanzhu Lv:** Investigation, Data curation. **Zuxun Lu:** Investigation, Data curation, Formal analysis. **Ketao Mu:** Conceptualization, Writing - review & editing, Visualization. **Xiaoxv Yin:** Conceptualization, Data curation, Writing - review & editing, Visualization, Supervision, Funding acquisition.

Acknowledgements

None.

Conflict of interest

All authors have no competing interests to declare.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2020.08.002.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sleep.2020.08.002.

References

[1] WHO. Coronavirus disease 2019 (COVID-19) Situation report - 111. 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200510covid-19-sitrep-111.pdf?sfvrsn=1896976f_2.
[2] WHO. COVID-19 strategy update 14 April 2020. 2020. https://www.who.int/docs/default-source/coronaviruse/covid-strategy-update-14april2020.pdf?sfvrsn=29da3ba0_19.
[3] General office of the state council, the People's Republic of China. 2020. http://www.gov.cn/xinwen/2020-01/26/content_5472235.htm.
[4] Pan X, Ojcius DM, Gao T, et al. Lessons learned from the 2019-nCoV epidemic on prevention of future infectious diseases. Microb Infect 2020;22(2):86–91.
[5] Wong ML, Lau EY, Wan JH, et al. The interplay between sleep and mood in predicting academic functioning, physical health and psychological health: a longitudinal study. J Psychosom Res 2013;74(4):271–7.
[6] Lange T, Dimitrov S, Born J. Effects of sleep and circadian rhythm on the human immune system. Ann N Y Acad Sci 2010;1193:48–59.
[7] Lee SM, Kang WS, Cho AR, et al. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. Compr Psychiatry 2018;87:123–7.
[8] Mohammed A, Sheikh TL, Gidado S, et al. An evaluation of psychological distress and social support of survivors and contacts of Ebola virus disease infection and their relatives in Lagos, Nigeria: a cross sectional study–2014. BMC Publ Health 2015;15:824.
[9] Chen R, Chou KR, Huang YJ, et al. Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: a longitudinal survey. Int J Nurs Stud 2006;43(2):215–25.
[10] Stranges S, Tigbe W, Gómez-Olivé FX, et al. Sleep problems: an emerging global epidemic? Findings from the INDEPTH WHO-SAGE study among more than 40,000 older adults from 8 countries across Africa and Asia. Sleep 2012;35(8):1173–81.
[11] Li Y, Bai W, Zhu B, et al. Prevalence and correlates of poor sleep quality among college students: a cross-sectional survey. Health Qual Life Outcome 2020;18(1):210.
[12] Xiao H, Zhang Y, Kong D, et al. The effects of social support on sleep quality of medical staff treating patients with Coronavirus disease 2019 (COVID-19) in January and February 2020 in China. Med Sci Mon Int Med J Exp Clin Res – Int Med J Exp Clin Res 2020;26:e923549.
[13] Liu X, Tang M, Hu L. Reliability and validity of the Pittsburgh sleep quality index. Chin J Psychiatry 1996;29:103–7 (in Chinese).
[14] Zhang C, Yang C, Li M, et al. The study of sleep quality of residents aged 18 and above in the community of Jixian street in Beichen District of Tianjin. Henan J Prev Med 2019;30(5):361–4 (in Chinese).
[15] Dong Z, Lou P, Zhang P, et al. Sleep quality and influencing factors in residents (≥ 18 years old) of Xuzhou city in 2013. Chin J Prev Contr Chron Dis 2014;22(6):654–8 (in Chinese).
[16] Yang Xiaoli LX, An Xiaoxia, Zhang Liang, et al. A survey on sleep quality of the people aged over 18 in Liaoning province. Health Educ Health Promot 2013;8(6):433–5 (in Chinese).
[17] Leung GM, Ho LM, Chan SK, et al. Longitudinal assessment of community psychobehavioral responses during and after the 2003 outbreak of severe acute respiratory syndrome in Hong Kong. Clin Infect Dis : Offic Publ Infect Dis Soc Am 2005;40(12):1713–20.
[18] Jeong H, Yim HW, Song YJ, et al. Mental health status of people isolated due to Middle East Respiratory Syndrome. Epidemiol Health 2016;38:e2016048.
[19] Su TP, Lien TC, Yang CY, et al. Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: a prospective and periodic assessment study in Taiwan. J Psychiatr Res 2007;41(1–2):119–30.
[20] Smith MW, Smith PW, Kratochvil CJ, et al. The psychosocial challenges of caring for patients with Ebola virus disease. Health Secur 2017;15(1):104–9.
[21] Richards A, Kanady JC, Neylan TC. Sleep disturbance in PTSD and other anxiety-related disorders: an updated review of clinical features, physiological characteristics, and psychological and neurobiological mechanisms. Neuropsychopharmacol – Offic Publ Am Coll Neuropsychopharmacol 2020;45(1):55–73.
[22] Koyanagi A, Garin N, Olaya B, et al. Chronic conditions and sleep problems among adults aged 50 years or over in nine countries: a multi-country study. PloS One 2014;9(12):e114742.
[23] Dao-Tran TH, Seib C. Prevalence and correlates of sleep disturbance among older women in Vietnam. J Clin Nurs 2018;27(17–18):3307–13.
[24] Shafazand S. Principles of gender-specific medicine || sleep in women. 2010. p. 244–51.
[25] Ko CH, Yen CF, Yen JY, et al. Psychosocial impact among the public of the severe acute respiratory syndrome epidemic in Taiwan. Psychiatr Clin Neurosci 2006;60(4):397–403.
[26] General office of the state council, the People's Republic of China. 2020. http://www.gov.cn:8080/zhengce/zhengceku/2020-02/26/content_5483427.htm.
[27] Koay YC, Stanton K, Kienzle V, et al. Effect of chronic exercise in healthy young male adults: a metabolomic analysis. Cardiovasc Res 2020, cvaa051, https://doi.org/10.1093/cvr/cvaa051.
[28] Yang SY, Lan SJ, Yen YY, et al. Effects of exercise on sleep quality in pregnant women: a systematic review and meta-analysis of randomized controlled trials. Asian Nurs Res 2020;14(1):1–10.
[29] Vanderlinden J, Boen F, van Uffelen JGZ. Effects of physical activity programs on sleep outcomes in older adults: a systematic review. Int J Behav Nutr Phys Activ 2020;17(1):11.
[30] Moldofsky H, Patcai J. Chronic widespread musculoskeletal pain, fatigue, depression and disordered sleep in chronic post-SARS syndrome; a case-controlled study. BMC Neurol 2011;11:37.
[31] Booker LA, Magee M, Rajaratnam SMW, et al. Individual vulnerability to insomnia, excessive sleepiness and shift work disorder amongst healthcare shift workers. A systematic review. Sleep Med Rev 2018;41:220–33.
[32] Muscogiuri G, Barrea L, Annunziata G, et al. Obesity and sleep disturbance: the chicken or the egg? Crit Rev Food Sci Nutr 2019;59(13):2158–65.
[33] Lee RZY, Yu J, Rawtaer I, et al. CHI study: protocol for an observational cohort study on ageing and mental health in community-dwelling older adults. BMJ Open 2020;10(5):e035003.