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.

International Journal of Nursing Studies Advances 3 (2021) 100026

Contents lists available at ScienceDirect

International Journal of Nursing Studies Advances

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

Nurses reports of actual work hours and preferred work hours per shift among frontline nurses during coronavirus disease 2019 (COVID-19) epidemic: A cross-sectional survey

Xia Zhang[a], Zhixia Jiang[b,c,d,*], Xiaoli Yuan[a], Ying Wang[b], Di Huang[b], Rujun Hu[a], Jiamei Zhou[a], Fang Chen[a]

[a] Affiliated Hospital of Zunyi Medical University, 149 Dalian Road, Huichuan District, Zunyi, Guizhou 563003, China
[b] Zunyi Medical University, Zunyi, China
[c] Jiangjunshan Hospital of Guizhou Province, Guiyang, China
[d] Guizhou Nursing Vocational college

ARTICLE INFO

Keywords:
Coronavirus disease 2019
Epidemic
Nurse
Influencing factors
Work hours

ABSTRACT

Background: The Coronavirus disease (COVID-19) pandemic is an ongoing pandemic all over the world, leading to 126, 372, 442 people diagnosed and 2, 769, 696 deaths globally as of March 28, 2021. Nurses are providing care to patients with COVID-19 who require hospitalization. To ensure adequate response capacity and to maintain the health of nurses, it is important to analyse the actual work hours and the nurses reported preferred work hours per shift among frontline nurses.

Objective: To analyse the actual work hours and preferred work hours per shift of nurses reports among frontline nurses fighting the COVID-19 epidemic and to explore the influencing factors on the nurses reported preferred work hours.

Design: Cross-sectional survey

Setting(s): This study was conducted in 10 designated hospitals providing treatments to patients with COVID-19 in China.

Participants: Nurses providing care to patients with COVID-19 in designated hospitals in China.

Methods: A questionnaire with open-ended questions was used to assess frontline nurses caring for COVID-19 cases in 10 designated hospitals. Quantitative and qualitative methods were used to analyse the actual work hours, the nurses reported preferred work hours and factors influencing nurses reported preferred work hours among the frontline nurses.

Results: A total of 109 nurses responded to the survey. The shift length exceeded the nurses' preferred work hours [Median (interquartile range): 5.00 (2.00) h vs 4.00 (2.00) h; Minimum-Maximum: 4–12 h vs 4–8 h], and 60.55% (66/109) of the nurses regarded 4 h as the preferred number of work hours per shift. Five key themes associated with the influencing factors emerged, including circumstances; personal preventable equipment; the nurses' physical and emotional needs of nurse; and the nurses' safety needs and work intensity.

Conclusions: These findings suggest that there is a gap between the actual work hours and the nurses preferred work hours among frontline nurses in different units and different posts. The main influencing factors were circumstances, personal protective equipment, the nurses' physical and emotional needs, and the nurses' safety needs and work intensity.

* Corresponding author at: Guizhou Nursing Vocational College, Dazhi Road, Huaxi District, Guiyang, Guizhou 550025, China.
E-mail address: jzxhl@126.com (Z. Jiang).

https://doi.org/10.1016/j.ijnsa.2021.100026
Received 11 March 2021; Received in revised form 17 March 2021; Accepted 18 March 2021
Available online 28 March 2021

1. Background

The novel coronavirus disease (COVID-19) that emerged in December, 2019 (Wang et al., 2020) is still an ongoing pademic around the world. As of March 28, 2021, data from the World Health Organization (WHO) showed that the number of confirmed cases of COVID-19 has increased to 126, 372, 442, and the number of deaths has risen to 2, 769, 696 (World Health Organization, 2021). On January 20, 2020, China incorporated COVID-19 into the group of class B infectious diseases and managed it according to class A procedures (National Health Commission of the People's Republic of China, 2020). On March 11, 2020, the WHO declared COVID-19 epidemic a public health emergency of international concern (WHO, 2020). Medical institutions, especially hospitals, were to increase their preparedness for a surge of patients with COVID-19 who would require hospitalization. The work hours per shift among nurses, who serve as important members of medical and health institutions play a key role in the response effects of the epidemic and in nurses' physical and mental health (Lam et al., 2018). Previous evidence has suggested that work hours for nurses could affect quality of care (Griffiths et al., 2014). The National Health Commission of the People's Republic of China (National Health Commission of the PRC) recommended 4 h per shift for intensive care unit nurses in the hospitals providing treatment to patients with COVID-19 (Nutional Health Commission of the People's Republic of China, 2020). Related studies have also reported work hours per shift of frontline nurses in their studies (Chen et al., 2020; Zheng et al., 2020). However, given that many units and different posts were involved in the treatment of patients with COVID-19, the nurses reported preferred work hours per shift of different units and posts are still unknown. Therefore, the aim of this study is to investigate and analyse the actual work hours and the nurses reported preferred work hours per shift for different units and posts among frontline nurses in China. In addition, we will explore the factors influencing the nurses reported preferred work hours through summary content analysis.

2. Methods

2.1. Study design and participants

This study was a cross-sectional survey. A questionnaire with open-ended questions was used to gather quantitative data and qualitative data. Nurses providing care to patients with COVID-19 in 10 designated hospitals (Egang Hospital, Second Hospital of Ezhou, Third People's Hospital of Ezhou, Central Hospital of Ezhou, Hubei Provincial hospital of Tradition Chinese Medicine, Jiangjunshan Hospital of Guizhou Provence, People's Hospital of Guizhou Province, Affiliated Hospital of Zunyi Medical University, First Affiliated Hospital of Nanchang University and Yichang Point Military District Hospital) were investigated with a convenient sampling method for working closely to the authors or researchers involved in this study. The authors and researchers were deployed to these designated hospitals during the period of the study and were recruited participants in their respective areas. Approximately 10~100 potential participants in each designated hospital were known to the authors and researchers and finally a total of 109 nurses agreed to participate in this study.This facilitated the recruitment of participants in the respective areas of the designated hospitals and ensured that the sample was representative of all individuals working in this setting. As there were no previous studies in similar populations available, no formal sample size calculation was performed.

2.2. Inclusion and exclusion criteria

Nurses were eligible to participate if they were deployed to designated hospitals with COVID-19 patients, and if they know the purpose of the survey and they were willing to participate in the survey. Nurses who had difficulties with reading and comprehension or showed disagreement with publication of survey results were excluded from the survey.

2.3. Ethical approval

Prior to data collection, ethical approval was granted by Zunyi Medical University (No: [2020]1-001). The study was conducted based on the principles of the Declaration of Helsinki. Confidentiality was ensured for all participants in the declaration at the beginning and participants were asked to fill out the questionnaire anonymously. Most importantly, they had been informed to participate in the survey on their will.

2.4. Data collection

A questionnaire with open-ended questions in Chinese was designed. The content of the questionnaire mainly includes the baseline characteristics of nurses (gender, age, professional title, educational background, job post, days of caring patients with COVID-19, etc), the actual work hours per shift, nurses reported preferred work hours per shift and the reasons or factors influencing preferred work hours.

Given that the high risk of infection for the COVID-19, this survey was conducted on line. The questionnaire was imported into a web site called "Questionnaire star", and the QR code or the URL of the questionnaire was shared with nurses who agreed to participate in the survey by Wechat from February 24 to March 12, 2020. Nurses were required to complete the questions according to the instruction and their true feelings. The URL for the questionnaire was https://www.wjx.cn/jq/57198418.aspx.

Table 1
Characteristics of participants (n=109).

Items	Nurses (n, %)
Gender	
Man	21 (19.27%)
Female	88 (80.73%)
Age (years)	
Median (IQR)	30.00 (6.00)
Years of service years	
Median (IQR)	7.00 (6.00)
Professional title	
Junior	82 (75.23%)
Secondary	26 (23.85%)
Senior	1 (0.92%)
Education	
Associate degree	7 (6.42%)
Bachelor's degree	96 (88.07%)
Master degree or above	6 (5.50%)
Days spending caring for patients with COVID-19	
Median (IQR)	18.00 (11.00)
Designated Hospitals	
Egang Hospital	1 (0.92%)
Second Hospital of Ezhou	1 (0.92%)
Third People's Hospital of Ezhou	3 (2.75%)
Central Hospital of Ezhou	17 (15.60%)
Hubei Provincial hospital of Tradition Chinese Medicine	1 (0.92%)
Jiangjunshan Hospital of Guizhou Provence	12 (11.01%)
People's Hospital of Guizhou Province	3 (2.75%)
Affiliated Hospital of Zunyi Medical University	64 (58.72%)
First Affiliated Hospital of Nanchang University	6 (5.50%)
Yichang Point Military District Hospital	1 (0.92%)
Provinces	
Guizhou	79 (72.48%)
Hubei	23 (21.10%)
Jiangxi	7 (6.42%)

SD means standard deviation.

2.5. Data analysis

2.5.1. Statistical analysis

Survey data were entered into Microsoft Excel (version 2010) and SPSS 22.0 (IBM SPSS statistics, IBM Corporation, USA), and reviewed for coding accuracy. Demographic and survey data were summarized using descriptive statistics: median with interquartile range (IQR), and frequencies with percentages. Range from minimum to maximum (Min - Max) was also used to summary work hours for nurses in different units and posts.

2.5.2. Content analysis

Because the open-ended questions on the questionnaire were optional, response rate for each behaviour varied, and 44 participants completed the open-ended questions describing the reasons or factors influencing the preferred work hours. All responses were transcribed into Microsoft Excel (version 2010) for a summative content analysis (Booker et al., 2019; Elo and Kyngas, 2008). After a thorough reading, responses were collated into categories and themes. Frequencies were calculated for each reason reported, and an illustrative quote was chosen to represent an influencing factor.

3. Results

3.1. Demographic description

A total of 109 nurses from 10 hospitals in 3 provinces had responded the investigation, 80.73% (88/109) of whom were female. These nurses were 30 (IQR: 6.00) years old and had provided care to patients with COVID-19 for 18 (IQR: 11) days. Characteristics of nurses who had participated in the survey were showed in Table 1.

3.2. Work hours

Our results showed that actual work hours were longer than nurses reported preferred work hours for frontline nurses [Median (IQR): 5.00 (2.00) h vs 4.00 (2.00) h; Min-Max: 4 - 12 h vs 4–8 h], and 60.55% (66/109) of the nurses regarded 4 h as the preferred number of work hours per shift (Table 2).

Table 2
Number of frontline nurses, actual work hours and preferred work hours per shifts (n=109).

Items (h)	Nurses (n, %)
Actual work hours Median (IQR)	5.00 (2.00)
4	42 (38.53%)
5	23 (21.10%)
6	28 (25.69%)
8	12 (11.01%)
10	1 (0.92%)
11	1 (0.92%)
12	2 (1.83%)
Preferred work hours Median (IQR)	4.00 (2.00)
4	66 (60.55%)
5	15 (13.76%)
6	16 (14.68%)
8	12 (11.01%)

IQR means interquartile range.

Table 3
Hours of work per shift among frontline nurses in different units and posts (n=109).

Items	Nurses (n, %)	Actual work hours (h)		Preferred work hours (h)	
		Median (IQR)	Min - Max	Median (IQR)	Min - Max
Units					
Intensive care unit*	49 (44.95%)	4 (2.00)	4–8	4 (0.00)	4–8
Isolation ward*	33 (30.28%)	6 (1.00)	4–12	5 (2.00)	4–8
Isolation ward#	15 (13.76%)	5 (0.00)	4–8	5 (1.00)	4–5
Fever clinics	6 (5.50%)	6 (7.25)	4–12	4 (2.00)	4–6
Other unit	6 (5.50%)	5.5 (1.00)	5–6	5 (1.25)	4–6
Posts					
Management	4 (3.67%)	8 (1.50)	8–10	4 (3.00)	4–8
Direct nursing$	88 (80.73%)	5 (2.00)	4–6	4 (1.00)	4 - 6
Indirect nursing&	11 (10.09%)	8 (2.00)	6–8	8 (2.00)	4 - 8
Other post	6 (5.50%)	6 (4.25)	4–12	5 (4.00)	4 - 8

* Confirmed case treatment units
# Suspected case treatment unit
$ Nurses in the direct nursing posts need to wear personal preventable equipment and provide services to patients directly; $ Nurses in the indirect nursing posts prepare medicine and supplies, they do not need to wear personal protective equipment or provide care to patients directly; IQR means interquartile range; Min - Max means range from minimum to maximum.

In terms of different units, the actual work hours of nurses working in intensive care unit for confirmed cases were the same as those of nurses working in the suspected cases treatment units, specifically, Min - Max: 4–8 h. Nurses in isolation wards and fever clinics worked longer time than the nurses reported preferred work hours (Table 3).

In contrast, the actual work hours of nurses in direct nursing posts were Min - Max: 4-6 h per shift, and the actual work hours of nurses in other posts were longer than the nurses reported preferred work hours. In addition, the actual work hours and the nurses reported preferred work hours of nurses in the direct nursing post were fewer than those of other posts (Table 3).

3.3. Reasons/factors influencing the nurses reported preferred work hours

A total of 40.37% (44/109) of nurses described the reasons for the nurses reported preferred work hours. After thorough reading, responses were collated into categories, and 5 themes emerged, including circumstances; personal protective equipment; the nurses' physical and emotional needs; and the nurses' safety needs and work intensity.

3.3.1. Circumstances

Given that different units and posts have different requirement, nurses suggested setting work hours according to different circumstances.

It is ideal to set work hours according to different units and posts. (Nurse 107)

Work hours for nurses in direct posts must be fewer than those for nurses in indirect posts, because that nurses in direct posts experience high risk of infection and cannot eat or go to toilet timely. (Nurse 107)

3.3.2. Personal protective equipment

The main problems of the personal protective equipment were that nurses had to spend large amount of time wearing and putting off it, and fog drops appeared on the goggles which could block nurses' line of sight. Moreover, pain, dehydration, sweating and other symptoms of discomfort occurred during the use of personal protective equipment. All those problems could affect the work hours.

We had to spend some time wearing personal protective equipment. (Nurse 98)

So much sweat in the protective clothing and goggles. (Nurse 66)

The goggles will fog over time. (Nurse 97)

I felt my chest was compressed tightly by the personal protective equipment, and I could not breathe. (Nurse 13)

3.3.3. The physical and emotional needs of nurses

The physiological and psychological needs of nurses mainly included respiratory needs, getting adequate rest, eating food and going to the toilet, because nurses are prone to hypoxia, dyspnoea, headache, fatigue, hunger and stress during work.

I had a headache and difficulty breathing after 4 h with the personal protective equipment. (Nurse 11)

It was very uncomfortable for me to wear the personal protective equipment for a long time, moreover, I often feel hungry. (Nurse 12)

A 4 to 6 h per shift is reasonable; otherwise, I cannot hold my urine. (Nurse 78)

Due to too many night shifts, I felt sleepy all day. (Nurse 46)

Increase fatigue over four hours. (Nurse 88)

Four hours were ideal to meet physical and emotional needs. (Nurse 59)

3.3.4. The safety needs of nurses

Risk of infection increased with the working hours.

A 4 h shift was optimal, which can reduce the risk of infection and preserve physical strength. (Nurse 95)

3.3.5. Work intensity

Work intensity would affect the efficiency and endurance of nurses.

There were a lot of work (i.e., prepared oxygen cylinder, provided care to patient, observation of the condition of the patients) needed to be done. The workload was heavy. (Nurse 39)

Given the efficiency and endurance of a nurse, a 4 –5 h shifts were ideal. (Nurse 25)

4. Discussion

As the COVID-19 pandemic accelerates, with accompanying surge of patients with COVID-19 who will require healthcare, the pressure on the global health care workforce continues to intensify. The potentially overwhelming burden of illnesses that stressed the capacity of health systems and caused adverse effects, such as the risk of infection among health care workers has increased, affecting both nurses and the quality of healthcare that nurses provide. Numerous studies have focused on the effects of extended and shorten work hours on patients, nurses and organizations. Results from Lam et al. showed that human resource limitation is one of the main factors hindering emergency nurses' response to emerging infectious disease epidemic behaviour (Lam et al., 2019). Kunaviktikul et al. reported that the prolonged work hours of nurses can contribute to a series of adverse effects on nurses themselves, patients and the health system (Kunaviktikul et al., 2015). Bae et al. concluded that when the shift length was 12 h, patients' adverse outcomes (i.e., hypoglycaemia events or errors, proximity errors, and pneumonia death), adverse events reports, and dissatisfaction increased (Bae and Fabry, 2014). Patterson et al. pointed out that shorter shift durations were more beneficial to mitigate fatigue and fatigue-related risks than longer shift durations (Patterson et al, 2018). How to manage frontline nurses' work hours scientifically and how to ensure their physical and mental safety while improving their response readiness are urgent problems for health managers to address.

The results of this study showed that the actual work hours of the frontline nurses were longer than the nurses' reported preferred work hours [Median (IQR): 5.00 (2.00) h vs 4.00 (2.00) h; Min-Max: 4 - 12 h vs 4 - 8 h]. In addition, 60.55% (66/109) of nurses considered 4 h to be the preferred length of work per shift (Table 2), which was consistent with the recommendation of 4 h by the National Health Commission of the PRC on February 29,2020 (Nutional Health Commission of the People's Republic of China, 2020). In terms of the different units of analysis, the actual work hours of intensive care unit nurses were the same as the nurses reported preferred work hours, and the actual work hours of the remaining units were longer than the nurses reported preferred work hours. This may be related to the fact that patients in the intensive care unit were in such serious condition that managers tended to allocate more nurses to this area. In contrast, the actual work hours of the direct nursing posts were the same as the nurses reported preferred work hours of nurses in different posts, the actual work hours of other posts were longer than the preferred work hours. However, our results also suggested that the work hours of direct nursing posts were fewer than those of indirect nursing posts (Table 3). This may be explained by nurse managers requiring nurses of indirect nursing posts to not wear personal protective equipment and work for longer hours to conserve protective equipment and human resources, because nurses without personal protective equipment can go to toilet or eat food timely. Peng et al. (2020) reported that they had set the nurses' work hours per shift to 12 h, 4h, and 2–3 h according to the workload and posts. Gagliano et al. (2020) also concluded that sub-district post management was beneficial to conserve manpower and protective equipment resources.

We also performed a summary content analysis of the nurses' reasons for the nurses reported preferred work hours. Five themes appeared which included circumstances; personal protective equipment; the nurses' physical and psychological needs; and the nurses'

safety needs and work intensity. Circumstances indicate that different units and posts have different requirements. Nurse 107: “It is ideal to set work hours according to different circumstances (units and posts)”. The main problems of the personal protective equipment were that nurses had to spend large amount of time wearing it, and fog drops appeared on the goggles which could block nurses’ line of sight. Moreover, pain, dehydration, sweating and other symptoms of discomfort occurred during the use of personal protective equipment. As far as the physiological and psychological needs of nurses are concerned, they mainly included respiratory needs, getting adequate rest, eating food and going to the toilet, because nurses are prone to hypoxia, dyspnoea, headache, fatigue, hunger and stress during work. For nurses’ safety needs, work hours can affect the risk of infection, e g, according to -Nurse 95: “4 h was preferred which can reduce the risk of infection and preserve physical strength”. Finally, work intensity encompassed the efficiency work and overwork, e g, as stated by- Nurse 39: “There was so much work (i.e., prepare oxygen cylinder, provide care to patient, observe of the condition of the patients) that needed to be done”. The results from an earlier study reported that COVID-19 was spread by human-to-human transmission via droplets or direct contact (Rothan and Byrareddy, 2020), and personal protective equipment is a necessary for medical staff to protect themselves from being infected. However, the use of personal protective equipment has resulted in many problems. Zhou et al reported that personal protective equipment could lead to sensory deprivation and a psychological stress response (Zhou et al., 2020). A survey of frontline doctors and nurses in West Africa by Den Boon et al found that the use of personal protective equipment resulted in sweating and dehydration among medical staff, and the prolonged use of goggles led to fog that their obscured vision, thus affecting their clinical practice (Den Boon et al., 2018). Xia et al reported that in the course of using personal protective equipment, pain, numbness, pressure, redness, or even damaged equipment related to the pressure damage are prone to occur (Xia et al., 2020). Zou et al conducted a semi-structured interview with 7 frontline nursing staff caring for COVID-19 patients and concluded that the frontline nursing staff had a heavy workload (Yao et al., 2020). All of these results were similar to the findings in our study.

The major strengths of this study were as follows. First, we analyzed the actual work hours and the nurses reported preferred work hours of frontline nurses in different units and posts. Second, the results of this study showed the gap between actual work hours and nurses reported preferred work hours for frontline nurses fighting the COVID-19 pandemic. Third, we used content analysis to explore the factors influencing preferred work hours, this method can provide important information to nurse managers.

The main limitations in this study were that the nurses preferred work hours per shift were obtained via nurse self-assessment, which may lack objectivity and reliability. Moreover, the time of implementation of this study was from February 24 to March 12, 2020, when nursing human resources and personal protective equipment had basically met clinical needs in China. Therefore, the results of this study may not be generalizable to medical institutions that have major shortages of nursing personnel and personal protective equipment.

5. Conclusions

This study suggests that there is a gap between the actual work hours and the nurses reported preferred work hours among nurses of different units and posts who provided care to patients with COVID-19. The main influencing factors come from five aspects, namely circumstances, personal protective equipment, the nurses’ physical and emotional needs, the nurses’ safety needs and work intensity.

What is already known about the topic?

- Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an ongoing global health emergency.
- Previous studies have documented that work hours played an important role in the quality of care and healthcare staff’s wellbeing.
- Currently, there are few studies on the actual work hours among frontline nurses during the outbreak of COVID-19 pandemic.

What this paper adds

- Nurses reported preferred work hours per shift among frontline nurses were from 4 to 8 h during the COVID-19 epidemic.
- There was a gap between the actual work hours and the nurses reported preferred work hours among frontline nurses.
- The factors influencing nurses reported preferred work hours included five themes as follows: circumstances; personal protective equipment; the nurses’ physical and emotional needs; and the nurses’ safety needs and work intensity.

Funding sources

This study was supported by the Guizhou Province Science Plan Program (Qian Ke He Zhicheng [2020] 4Y174) and the Guizhou Province Degree Office (Qian Degree He Zi ZDXK [2016]10).

Declaration of Competing Interest

None.

Acknowledgments

The authors thank all the participants and researcher for their contributions to this study.

References

Bae, S.H., Fabry, D., 2014. Assessing the relationships between nurse work hours/overtime and nurse and patient outcomes: systematic literature review. Nurs. Outlook 62 (2), 138–156. doi:10.1016/j.outlook.2013.10.009.

Booker, S., Herr, K., Tripp-Reimer, T., 2019. Black American older adults' motivation to engage in osteoarthritis treatment recommendations for pain self-management: a mixed methods study. Int. J. Nurs. Stud. 103510. doi:10.1016/j.ijnurstu.2019.103510, Advance online publication.

Chen, M., Fang, H., Li, L., 2020. The strategey of emergency management of human resources in hospital nursing for pheunonia infected by 2019 - nCoV. Modern Clin. Nurs. 19 (2). http://kns.cnki.net/kcms/detail/44.1570.R.20200213.1052.002.html.

Den Boon, S., Vallenas, C., Ferri, M., Norris, S.L., 2018. Incorporating health workers' perspectives into a WHO guideline on personal protective equipment developed during an Ebola virus disease outbreak. In: F1000Research, 7, p. 45. doi:10.12688/f1000research.12922.2.

Elo, S., Kyngäs, H., 2008. The qualitative content analysis process. J. Adv. Nurs. 62 (1), 107–115. doi:10.1111/j.1365-2648.2007.04569.x.

Gagliano, A., Villani, P.G., Co', F.M., Manelli, A., Paglia, S., Bisagni, P., Perotti, G.M., Storti, E., Lombardo, M, 2020. COVID-19 epidemic in the middle province of Northern Italy: impact, logistics, and strategy in the first line hospital. Disaster Med. Publ. Health Prep. 1–5. doi:10.1017/dmp.2020.51, Advance online publication.

Griffiths, P., Dall'Ora, C., Simon, M., Ball, J., Lindqvist, R., Rafferty, A.M., Schoonhoven, L., Tishelman, C., Aiken, L.H.RN4CAST Consortium, 2014. Nurses' shift length and overtime working in 12 European countries: the association with perceived quality of care and patient safety. Med. Care 52 (11), 975–981. doi:10.1097/MLR.0000000000000233.

Kunaviktikul, W., Wichaikhum, O., Nantsupawat, A., Nantsupawat, R., Chontawan, R., Klunklin, A., Roongruangsri, S., Nantachaipan, P., Supamanee, T., Chitpakdee, B., Akkadechanunt, T., Sirakamon, S., 2015. Nurses' extended work hours: patient, nurse and organizational outcomes. Int. Nurs. Rev. 62 (3), 386–393. doi:10.1111/inr.12195.

Lam, S., Kwong, E., Hung, M., Pang, S., Chiang, V., 2018. Nurses' preparedness for infectious disease outbreaks: a literature review and narrative synthesis of qualitative evidence. J. Clin. Nurs. 27 (7-8), e1244–e1255. doi:10.1111/jocn.14210.

Lam, S., Kwong, E., Hung, M., Pang, S., Chien, W.T., 2019. A qualitative descriptive study of the contextual factors influencing the practice of emergency nurses in managing emerging infectious diseases. Int. J. Qual. Stud. Health Well-Being 14 (1), 1626179. doi:10.1080/17482631.2019.1626179.

National Health Commission of the People's Republic of China, 2020. Notice on the Inclusion of Pneumonia in the Management of Statutory Infectious Diseases. National Health Commission of the People's Republic of China. http://www.nhc.gov.cn/xcs/zhengcwj/202001/44a3b8245e8049d2837a4f27529cd386.shtml.

Nutional Health Commission of the People's Republic of China, 2020. Nursing Standards for Patients of Severe Type and Critical Type with Coronavirus disease 2019 (COVID-19). Nutional Health Commission of the People's Republic of China. http://www.nhc.gov.cn/xcs/zhengcwj/202003/8235a35f35574ea79cdb7c261b1e666e/files/f4269c33b5a94135a124609252595613.pdf.

Patterson, P.D., Runyon, M.S., Higgins, J.S., Weaver, M.D., Teasley, E.M., Kroemer, A.J., Matthews, M.E., Curtis, B.R., Flickinger, K.L., Xun, X., Bizhanova, Z., Weiss, P.M., Condle, J.P., Renn, M.L., Sequeira, D.J., Coppler, P.J., Lang, E.S., Martin-Gill, C., 2018. Shorter versus longer shift durations to mitigate fatigue and fatigue-related risks in emergency medical services personnel and related shift workers: a systematic review. Prehospital. Emerg. Care 22 (sup1), 28–36. doi:10.1080/10903127.2017.1376135.

Peng, X., Peng, Y., Xiao, L., Jin, C., Liu, L., 2020. Practice of step-by-step nursing scheduling mode in medical team of assisting Hubei Province. Nurs. J. Chin. PLA 37 (2), 10–12. http://kns.cnki.net/kcms/detail/31.1825.R.20200225.0902.006.html.

Rothan, H.A., Byrareddy, S.N., 2020. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J. Autoimmun 109, 102433. doi:10.1016/j.jaut.2020.102433.

Wang, C., Horby, P.W., Hayden, F.G., Gao, G.F., 2020. A novel coronavirus outbreak of global health concern. Lancet 395 (10223), 470–473. doi:10.1016/S0140-6736(20)30185-9.

World Health Organization, 2021. Weekly epidemiological update on COVID-19 - 30 March 2021. World Health organization. https://www.who.int/publications/m/item/weekly-epidemiological-update-on-covid-19—31-march-2021.

World Health Organization (WHO), 2020a. Coronavirus Disease 2019 (COVID-19) Situation Report–72. World Health Organization, Geneva, Switzerland.

Xia, J., Duan, X., Cao, C., Zhang, J., Yu, C., Wang, K., 2020. Observation on the prevention effect of pressure injury on the nose and face of nurses responsible for preventing and controlling the novel coronavirus pneumonia. J. Nurs. Admin. http://kns.cnki.net/kcms/detail/11.4716.c.20200214.1738.002.html.

Yao, C., Jiang, T., Chen, X., Zheng, Z., 2020. Qualitative study on work stress of first-line nursing staff in children's hospital against new coronavirus pneumonia. Nurs. Rehab. 19 (2), 66–69. http://kns.cnki.net/KCMS/detail/detail.aspx?dbcode=CJFQ&dbname=CJFDLAST2020&filename=HLKF202002023&v=MDQwNjRSN3FmWStkcUZ5amxVcnpMTFNIQWFMRzRITkhNclk5SFo0UjhlWDFMdXhZUzdEaDFUM3FUcldNMUZyQ1U=.

Zheng, X., Zheng, L., Yang, Y., Yu, T., Hu, A., 2020. Discussion on the dispost and working mode of nursing staff of medical team in Hubei Province. Guangdong Med. J. 41 (4). doi:10.13820/j.cnki.gdyx.20200489.

Zhou, Y., Zhang, X., Fang, C., Huang, J., Yuan, Y., Chen, Y., 2020. A sensory deprivation based study on factors leading to psychological stress of medical providers in the novel coronavirus pneumonia. Chin. Med. Ethins. 33 (3). http://kns.cnki.net/kcms/detail/61.1203.R.20200318.0829.002.html.