



Quality of sleep and perceived stress among nurses during COVID 19 critical illness.

ISSN 2545-2533

Received: 10.01.2024

Accepted: 11.02.2024

First online: 12.02.2024

Published: 31.03.2024

Piladuwa Bogahakotuwe Gedara Erandima Sandamali¹ - A,B,C,D,E,F,G,I,K,L,M,N,O.

 ORCID www.orcid.org/0009-0007-7188-0331

Santhiyagu Nimeshika Akalanki Nimalarathne De Silva¹ - A,B,C,D,E,F,G,I,K,L,N,O.

 ORCID www.orcid.org/0009-0006-1926-4315

Dammala Liyanage Anusha Madushani¹ - A,B,C,D,E,F,G,I,K,L,N,O.

 ORCID www.orcid.org/0009-0005-1795-8658

Yonhewa Amanda Sanjali De Silva¹ - A,B,C,D,E,F,G,I,K,L,N,O.

 ORCID www.orcid.org/0009-0001-9740-1307

Ravi Umakantha Sudarshani Darshika¹ - A,B,C,D,E,F,G,I,K,L,N,O.

 ORCID www.orcid.org/0009-0003-8560-7679

Herath Hitihamilage Hashini Shashikala Sandakumari¹ - A,B,C,D,E,F,G,I,J,K,L,N,O.

 ORCID www.orcid.org/0000-0001-5567-7412

Koralage Tanika Gayani Kanchana¹ - A,B,C,D,E,F,G,I,J,K,L,N,O.

 ORCID www.orcid.org/0000-0002-3629-5061

¹ Faculty of Nursing, KIU Campus, Sri Lanka.

Address for correspondence:

P.B.K.G.E. Sandamali; Faculty of Nursing, KIU Campus,

No 249/1 Malabe Rd, Battaramulla, Sri Lanka.

Tel.: +94 713038095; E-mail: erandimasandamali@gmail.com

Author Contributions (CRediT Taxonomy):

Conceptualization - A

Data Curation - B

Formal Analysis - C

Funding Acquisition - D

Investigation - E

Methodology - F

Project Administration - G

Resources - H

Software - I

Supervision - J

Validation - K

Visualization - L

Writing (Draft Preparation) - M

Writing (Review & Editing) - N

Approved the final version - O

ABSTRACT

INTRODUCTION: Adequate sleep protects the mental and physical health of individuals while boosting brain and body functions. Significant lifestyle changes due to COVID 19 can affect the sleep quality and level of stress among nurses. The aim of the study was to evaluate the association between sleep quality and perceived stress among nurses during this COVID 19 outbreak.

MATERIALS AND METHODS: A descriptive cross-sectional study was conducted among 292 registered nurses in Sri Lanka through an anonymous online survey. Data were collected using self-administered, structured questionnaire that included Pittsburg Sleep Quality Index (PSQI) and the Perceived Stress Scale (PSS). SPSS 25 software (version 25) was used for data analysis.

RESULTS: The majority (79.8%) were between 26-35 years and females (93.5%). Among all participants, the average hours of sleep per night was 5.50 (± 1.07). The results of the PSQI scale revealed that 78.4 % of nurses had poor sleep quality (PSQI > 5points), while 67.1% of nurses had moderate level of perceived stress according to the PSS scale. Pearson's coefficient correlation demonstrated that, as nurses' sleep quality decreased, stress level of the nurses increased moderately ($r=0.53$).

CONCLUSIONS: The majority of nurses had poor sleep quality and moderate stress. Furthermore, it showed that there is a moderate positive correlation ($r=0.53$) between the PSQI global score and the perceived stress scale score.

KEY WORDS: COVID 19, nurses, perceived stress, sleep quality.

INTRODUCTION

The COVID 19 outbreak put the spotlight on the resilience of health systems and the emergency preparedness and response [1]. Health care workers are the backbone of health systems who face challenges in treating patients with COVID 19 [2]. Nurses as front-line healthcare professionals, the COVID 19 pandemic had affected their physical and mental health as well as their fundamental needs [3]. Sleep plays an important role in good health and well-being, where low sleep quality is considered as an indicator of many medical diseases and deterioration of brain functions [4].

Several studies found that there were significant impact of COVID 19 on nurses' sleep and psychological symptoms [4-7]. Du et al., 2020 found that more than half (59.0%) of front-line healthcare workers had moderate to severe levels of perceived stress [8]. Similarly, the prevalence of insomnia was 52.8% among nurses who fought against COVID-19 in Wuhan, China [9]. Furthermore, 60% of front-line and non-front line healthcare workers had poor sleep quality with moderate stress in Bahrain during COVID-19 [10]. Furthermore, some studies found associations between the sleep and stress levels among nurses [9,12]. Therefore, it is important to conduct a regular screening of healthcare workers who work to treat and diagnose COVID-19 patients to evaluate their psychological symptoms [11] and sleep quality.

Limited studies were conducted in Sri Lanka related to the psychological experiences of healthcare professionals, challenges and perceived needs among front-line healthcare workers during COVID 19 outbreak [13,14]. Therefore, the current study aimed to evaluate the association between sleep quality and perceived stress among nurses who had been working in both critical and non-critical care settings during the COVID 19 outbreak in Sri Lanka.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted among 292 nurses in Sri Lanka. Study data was collected using a structured questionnaire that included socio-demographic data, Pittsburg Sleep Quality Index (PSQI) [15], and Perceived Stress Scale (PSS) [16]. The questionnaire was distributed to Sri Lankan nurses through emails and social media from 25th November to 31st December 2021 using a snowball sampling strategy. At first, 20 emails were circulated to known nurses, and each nurse was asked to send at least another six persons. Before responding to the questionnaire, we disclosed the Participant Information Sheet (PIS) and informed that submitting the anonymous online questionnaire indicated written voluntary consent and if the participant was willing to be in the study, could enrol in the study.

All participants were allowed to withdraw from the study at any time. SPSS 25 software was used for data analysis. Inferential statistics, the Chi-square test and percentages were utilized in data analysis. Ethical approval (KIU/ERC/21/128) was obtained from the Ethics Review Committee of KIU Campus, Sri Lanka.

Pittsburg Sleep Quality Index (PSQI)

The PSQI (Pittsburg Sleep Quality Index) is a self-administered questionnaire comprising 19 self-administered questions and scores. The 19 self-related items are added together to generate seven component scores, each with a range of 0-3 points. In all circumstances, "0" denotes no difficulty and "3" denotes extreme difficulty. The seven component values are then summed together to provide a single "global" score that ranges from 0 to 21, with 0 denoting no difficulty and 21 denoting significant difficulty in all categories [15]. For the current study, PSQI had higher reliability ($\alpha = 0.824$).

Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) is a classic stress assessment instrument. Individual scores on PSS can range from 0 to 40 with higher scores indicating higher perceived stress. Scores ranging from 0-13, 14-26 and 27-40 would be considered low stress, moderate stress, and high perceived stress respectively [16]. For the current study, PSS had a higher reliability ($\alpha = 0.776$).

RESULTS

Sociodemographic and COVID 19 pandemic related data of the study population

A total of 292 nurses had responded to the online survey. Most were female nurses (93.5%) and aged (79.8%) between 26-35 years. The majority (51.0%) were unmarried, while 53.4% of the participants in the survey who worked in various hospitals at the Western province of Sri Lanka. 88.4% had worked with COVID 19 positive patients in different units in their hospitals. Although the majority (70.9%) of the total respondents had not suffered from COVID-19, and 55.1% of the participants had previously been quarantined for various reasons. However, among them, 37.3% were reported with positive results for the rapid antigen test or PCR test (Table 1).

Sleep Quality

The results of the PSQI scale demonstrated that usual bedtime was 11.00 pm while 30.1% of participants' usual getting up time was 5.00 am. The average number of minutes taken to fall asleep each night was 23.84 ± 18.65 minutes and the average hours of sleep per night was 5.50 ± 1.07 hours. According to the results, 31.8% only had six hours of sleep during the past month. Table 2 shows that the results of the characteristics which might cause trouble sleeping had been assessed on the PSQI scale. The majority of the participants had not shown the characteristics caused sleeping problems.

The PSQI global score ranges from 0-21 points. A score of less than 5 points indicates good sleep quality, and more than 5 points indicate poor sleep quality. Higher scores indicate worse sleep quality (Smyth, 1999). According to the results of the current study, the majority (78.4%) had poor sleep quality (PSQI > 5 points) while 21.6% had good sleep quality (PSQI < 5 points). The majority of the participants (36.0%) who responded from Western province had poor sleep quality (PSQI > 5 points).

Table 1. Sociodemographic data of study population.

Variables	Frequency (n=292)	Percentage (%)
Age		
Below 25	10	3.4
Between 26-35	233	79.8
Between 36-45	41	14.0
Between 46-55	6	2.0
More than 56	2	0.7
Gender		
Female	273	93.5
Male	19	6.5
Marital Status		
Married	142	48.6
Unmarried	149	51.0
Widower	1	0.3
Province		
Northern	7	2.4
North-Central	8	2.7
North-Western	2	0.7
Central	48	16.4
Eastern	4	1.4
Western	156	53.4
Sabaragamuwa	3	1.0
Uwa	1	0.3
Southern	63	21.6
Directly involved in care of COVID 19 patients		
Yes	258	88.4
No	34	11.6
Confirmed for COVID 19		
Yes	85	29.1
No	207	70.9
Ever been quarantine		
Yes	161	55.1
No	131	44.9
Results for COVID 19 test		
RAT/PCR		
Positive	109	37.3
Negative	183	62.7

RAT - Rapid Antigen Test, PCR - Polymerase Chain Reaction

As shown in Table 3, marital status ($p = 0.042$), province ($p = 0.003$) and positive test results (RAT or PCR) for COVID 19 ($p = 0.050$) were significantly associated with sleep quality of the nurses. In addition to the above findings, there was a significant association between home problems ($p = 0.001$), shift work ($p = 0.001$), long distance travel ($p = 0.001$), perceived stress ($p = 0.001$), sleeping with a child in the same bed ($p = 0.001$), and workload ($p = 0.001$) with the quality of sleep among nurses during the COVID 19 pandemic situation.

Table 2. Results of Pittsburg Sleep Quality Index (PSQI).

Statement	“Not during the past month”	“Less than once a week”	“Once or twice week”	“Three or more times a week”
a) „Cannot get to sleep within 30 minutes”	124 (42.5%)	74 (25.3%)	53 (18.2%)	41 (14.0%)
b) „Wake up in the middle of the night or early morning”	80 (27.4%)	95 (32.5%)	74 (25.3%)	43 (14.7%)
c) „Have to get up to use the bathroom”	132 (45.2%)	93 (31.8%)	50 (17.1%)	17 (5.8%)
d) „Cannot breathe comfortably”	190 (65.1%)	55 (18.8%)	41 (14.0%)	6 (2.1%)
e) „Cough or snore loudly”	190 (65.1%)	59 (20.2%)	39 (13.4%)	4 (1.4)
f) „Feel too cold”	164 (56.2%)	75 (25.7%)	44 (15.1%)	9 (3.1%)
g) „Feel too hot”	170 (58.2%)	63 (21.6%)	37 (12.7%)	22 (7.5%)
h) „Had bad dreams”	187 (64.0%)	56 (19.2%)	42 (14.4%)	7 (2.4%)
i) „Have pain”	153 (52.4%)	51 (17.5%)	64 (21.9%)	24 (8.2%)

Table 3. Association between participants' characteristics and Pittsburg Sleep Quality Index (PSQI).

Variables	Participants' Sleep Quality (n=292)		P value
	Poor sleep quality (78.4%)	Good sleep quality (21.6%)	
Marital Status			
Married	106 (36.3%)	36 (12.3%)	0.042
Unmarried	123 (42.1%)	26 (8.9%)	
Widower	0 (0%)	1 (0.34%)	
Province			
Northern	7 (2.4%)	0 (0%)	0.003
North-Central	7 (2.4%)	1 (0.34%)	
North-Western	2 (0.68%)	0 (0%)	
Central	47 (16.1%)	1 (0.34%)	
Eastern	4 (1.37%)	0 (0%)	
Western	105 (36.0%)	51 (17.5%)	
Sabaragamuwa	3 (31.0%)	0 (0%)	
Uwa	1 (0.34%)	0 (0%)	
Southern	53 (18.2%)	10 (3.4%)	
Positive test results for COVID 19 (RAT/PCR)			
Yes	92 (31.5%)	17 (5.8%)	0.050
No	137 (47.0%)	46 (15.6%)	

Table 4. Results of the Perceived Stress Scale (PSS).

Statement	“Never”	“Almost never”	“Sometimes”	“Fairly often”	“Very often”
1. <i>In the last month, how often have you been upset because of something that happened unexpectedly?</i>	26 (8.9%)	74 (25.3%)	58 (19.9%)	64 (21.9%)	70 (24.0%)
2. <i>In the last month, how often have you felt that you were unable to control the important things in your life?</i>	38 (13.0%)	63 (21.6%)	65 (22.3%)	67 (22.9%)	59 (20.2%)
3. <i>In the last month, how often have you felt nervous and stressed?</i>	5 (1.7%)	35 (12.0%)	69 (23.6%)	56 (19.2%)	127 (43.5%)
4. <i>In the last month, how often have you felt confident about your ability to handle your personal problems?</i>	18 (6.2%)	40 (13.7%)	91 (31.2%)	60 (20.5%)	83 (28.4%)
5. <i>In the last month, how often have you felt that things were going your way?</i>	49 (16.8%)	59 (20.2%)	75 (25.7%)	55 (18.8%)	54 (18.5%)
6. <i>In the last month, how often have you found that you could not cope with all the things that you had to do?</i>	27 (9.2%)	69 (23.6%)	79 (27.1%)	71 (24.3%)	46 (15.8%)
7. <i>In the last month, how often have you been able to control irritations in your life?</i>	15 (5.1%)	57 (19.5%)	70 (24.0%)	82 (28.1%)	68 (23.3%)
8. <i>In the last month, how often have you felt that you were on top of things?</i>	26 (8.9%)	53 (18.2%)	98 (33.6%)	86 (29.5%)	29 (9.9%)
9. <i>In the last month, how often have you been angered because of things that happened that were outside of your control?</i>	13 (4.5%)	63 (21.6%)	65 (22.3%)	77 (26.4%)	74 (25.3%)
10. <i>In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?</i>	16 (5.5%)	58 (19.9%)	83 (28.4%)	73 (25.0%)	62 (21.2%)

Participants' Perceived Stress

The perceived stress was measured using the PSS scale. It was found that the majority of participants 67.1% had moderate stress, while 21.3% and 11.6% had high perceived stress, and low stress respectively. Table 4 shows the results of the PSS scale.

Findings of the correlation coefficient

Figure 1 shows the relationship between sleep quality and perceived stress among participants. It shows that there is a moderate positive correlation ($r = 0.53$) between the PSQI global score and the perceived stress scale score. As shown in Figure 2, there is a moderate negative correlation ($r = -0.6$) between the hours slept per night and the global PSQI score. As the participants slept more hours, the PSQI global score decreased which represents better sleep quality for nurses. However, there was a weak negative correlation ($r = -0.27$) between the number of hours that they sleep and their perceived stress level (Table 5 & Figure 1, 2, & 3).

Table 5. Correlation of PSQI global score, Perceived Stress Scale score and hours slept per night.

Factors	Correlation (r)	P value
PSQI global score and Perceived stress scale score	+0.53	0.001
Hours slept per night and PSQI global score	-0.6	0.001
Hours slept per night and perceived stress level	-0.27	0.001

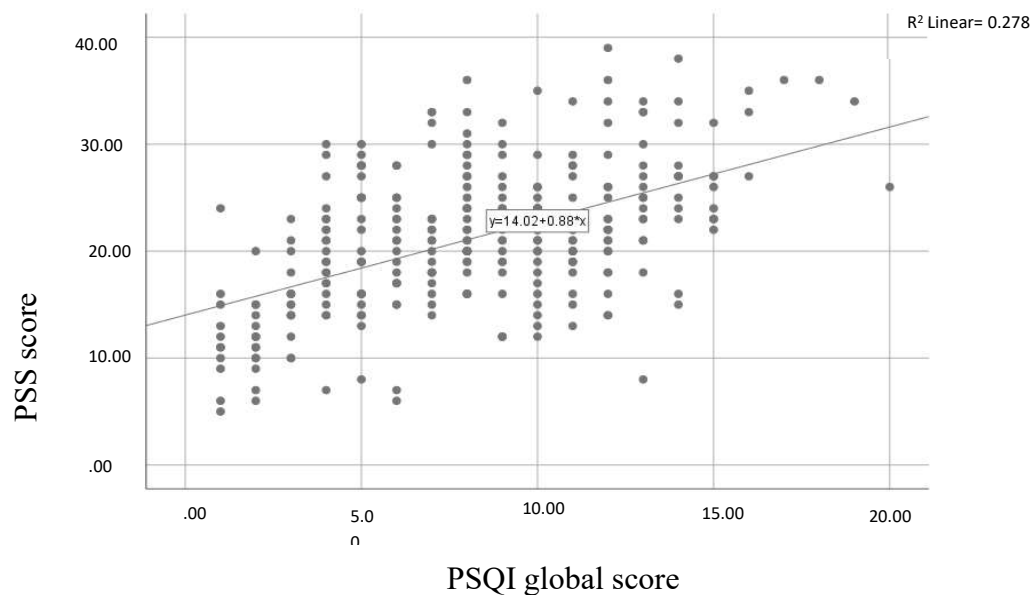


Figure 1. Relationship between PSQI global score and Perceived Stress Scale score.

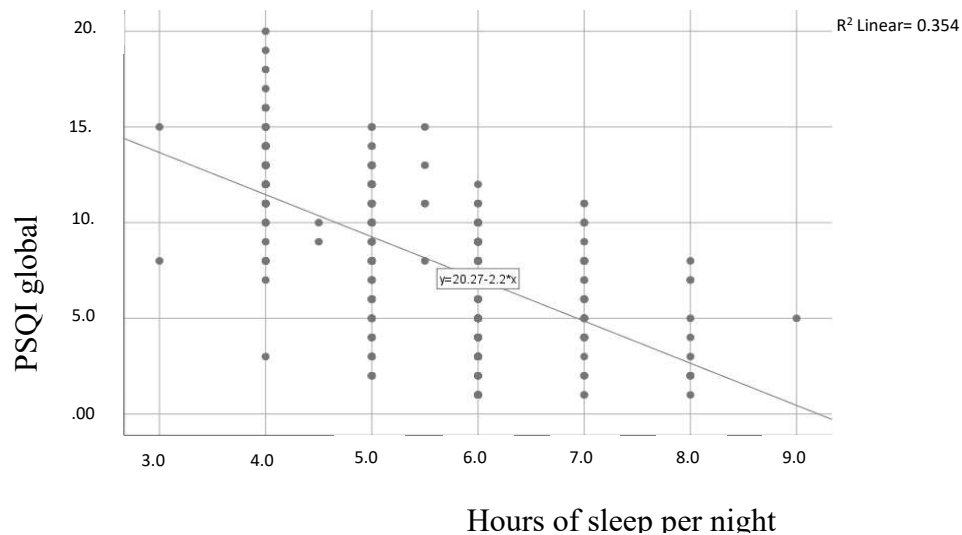


Figure 2. Relationship between the hours of sleep per night and PSQI global score.

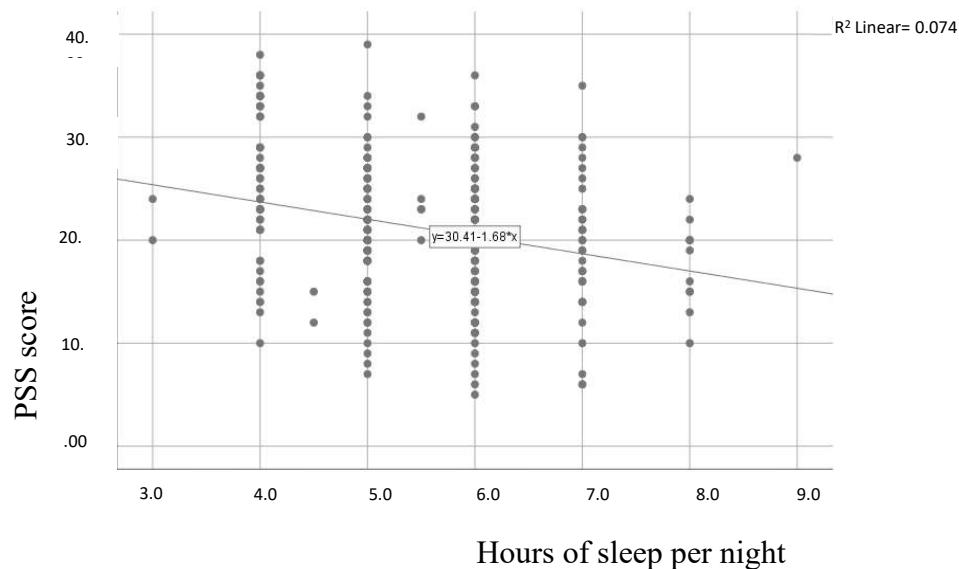


Figure 3. Relationship between the hours of sleep per night and Perceived Stress Scale score.

DISCUSSION

Most of the studies conducted at the beginning of the COVID 19 pandemic in China revealed that nurses who worked in Wuhan reported more severe symptoms of insomnia and stress, since COVID 19 was a newly identified unexpected viral disease [9,17]. In the current study, most had poor sleep quality and a moderate level of perceived stress. Nurses are especially involved in patient care and treatment process where they may not receive enough personal protective equipment and facilities to handle patients at the very beginning of the COVID 19 pandemic. Therefore, there may be severe stress symptoms among nurses while working at the beginning of the pandemic in China [6,18].

Over time, most of the later studies found that the stress level was becoming a moderate state [10,19] similar to the results of the current research study. This may be due to adopting the nurses with existing knowledge by explanatory approaches by researchers for dealing with the patients and well-equipped hospital settings to face the pandemic. This study found that most nurses had poor sleep quality (PSQI score > 5 points). Chinese studies that were conducted at the beginning and later stages of the first peak of the pandemic reported that most participants scored more than 5 points in the global PSQI global score [5,20]. Similarly, some studies were carried out after the first peak stage of the pandemic in other counties that also reported poor sleep quality (PSQI score > 5 points) among the majority of participants [10,21,22]. Some studies found that the global PSQI score remained between 6-10 points in which the sleep quality of nurses is moderate [5,23,24].

Marital status ($p = 0.042$), province ($p = 0.003$) and positive test results for COVID 19 (RAT or PCR) ($p = 0.050$) were significantly associated with the quality the sleep of the participants ($p < 0.05$) in this study. However, in contrast, an online survey conducted among front-line and non-front line healthcare workers in Bahrain reported that there was no significant relationship between marital status ($p = 0.5$) and the sleep quality of the nurses, Further, it was found that the province ($p = 0.003$) was a highly significant factor related to the sleep quality [10]. Most of the participants had participated from Western Province ($n=156$) for this study. Parallel to that, most nurses in the Western province had a higher workload due to increased numbers of COVID 19 patients in the Western province compared to other provinces in Sri Lanka since the population density of the Western province is high. Hence, this might severely affect the nurses' sleep quality. A study carried out among 469 health workers including nurses in Saudi Arabia found that the participants who were classified according to the stress levels differed significantly by gender and age while the present study had not identified a significant relationship. Supporting the findings of Saudi Arabia, age ($p = 0.029$) and gender ($p = 0.055$) were significantly associated with the level of stress among nurses in Turkey [21].

The finding of the current study showed that when the of nurses sleep quality deteriorates, the level of stress increase ($r = 0.52$). Similar to that, a study conducted in Turkey reported a correlation between nurses' perception of high stress levels and poor sleep quality ($r = 0.52$) during COVID 19. They also identified that shift work ($p < 0.001$) was significantly affected sleep quality similar to the current study ($p = 0.001$) [21]. According to the study conducted on impact of shift work on sleep quality among nurses participating in shift work and non-shift workers in 2016, the mean of the PSQI score was higher in shift work nurses than the non-shift work nurses which represented poor sleep quality [25]. Hence, even before the COVID 19 pandemic sleep quality of the nurses were affected by the work duties allocated to nurses. However, the current COVID-19 pandemic has made changes in the shift work pattern rather than the earlier shift work schedule increasing its burden.

Limitations - First, we used the cross-sectional study. From that we collected the data confined to some specific time period. But the spread of COVID 19 virus and the severity of the cases has fluctuated from time to time. Therefore, we were unable to collect the data in the different stages of the pandemic.

Second, we could not achieve the calculated sample size in the present study. Third, the existing knowledge regarding the research problem means the literature was confined to recent 2 years and few studies were found to be reviewed. Finally, we were unable to address potential confounders such as COVID 19 vaccinated status, chronic illnesses, adequate facilities, travel history, status of the family, etc. in our study.

CONCLUSIONS

The present study showed that about 78.4% of nurses had poor sleep quality and 67.1% had moderate stress during the COVID 19 outbreak. Marital status, province, and positive test results for COVID 19 (RAT or PCR) were significantly associated with the sleep quality of the nurses. Furthermore, there was a positive correlation between the PSQI global score and the PSS score that declared as the quality of nurses' sleep deteriorated, the level of stress increased. It is important to develop intervention programmes to improve the working environment that would impact sleep quality and teach distraction strategies and relaxation techniques to minimise stress among nurses.

SUPPLEMENTARY INFORMATION

Funding: No fund was received related to this study.

Institutional Review Statement: The study was conducted according to the guidelines of the Declaration of Helsinki.

Informed Consent Statement: Not applicable

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

REFERENCES

- [1] Aruru M, Truong HA, Clark S. Pharmacy Emergency Preparedness and Response (PEPR): a proposed framework for expanding pharmacy professionals' roles and contributions to emergency preparedness and response during the COVID-19 pandemic and beyond. *Res Social Adm Pharm.* 2021; 17(1): 1967-1977. doi: <https://doi.org/10.1016/j.sapharm.2020.04.002>
- [2] International Labour Organization. (2020). [WWW]: <https://www.ilo.org/global/topics/coronavirus/lang--en/index.htm> (accessed 05 August 2023)
- [3] Maben J, Bridges J. Covid-19: Supporting nurses' psychological and mental health. *J Clin Nurs.* 2020; 29(15-16): 2742-2750. doi: <https://doi.org/10.1111/jocn.15307>
- [4] Zielinski MR, McKenna JT, McCarley RW. Functions and mechanisms of sleep. *AIMS Neurosci.* 2016; 3(1): 67-104. doi: <https://doi.org/10.3934/Neuroscience.2016.1.67>
- [5] Tu ZH, He JW, Zhou N. Sleep quality and mood symptoms in conscripted frontline nurse in Wuhan, China during COVID-19 outbreak: A cross-sectional study. *Medicine* 2020; 99(26): e20769. doi: <https://doi.org/10.1097/MD.00000000000020769>

- [6] Al Maqbali M, Al Sinani M, Al-Lenjawi B. Prevalence of stress, depression, anxiety and sleep disturbance among nurses during the COVID-19 pandemic: A systematic review and meta-analysis. *J Psychosom Res.* 2021; 141: 110343.
doi: <https://doi.org/10.1016/j.jpsychores.2020.110343>
- [7] Pang Y, Fang H, Li L, Chen M, Chen Y, Chen M. Predictive factors of anxiety and depression among nurses fighting coronavirus disease 2019 in China. *Int J Ment Health Nurs.* 2021; 30(2): 524-532.
doi: <https://doi.org/10.1111/inm.12817>
- [8] Du J, Dong LU, Wang T, Yuan C, Fu R, Zhang L, et al.. Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *Gen Hosp Psychiatry.* 2020; 67: 144-145.
doi: <https://doi.org/10.1016/j.genhosppsy.2020.03.011>
- [9] Zhan Y, Liu Y, Liu H, Li M, Shen Y, Gui L, et al.. Factors associated with insomnia among Chinese front-line nurses fighting against COVID-19 in Wuhan: A cross-sectional survey. *J Nurs Manag.* 2020; 28(7): 1525-1535.
doi: <https://doi.org/10.1111/jonm.13094>
- [10] Jahrami H, BaHammam AS, AlGahtani H, Ebrahim A, Faris M, AlEid K, et al.. The examination of sleep quality for frontline healthcare workers during the outbreak of COVID-19. *Sleep Breath.* 2021; 25(1): 503-511.
doi: <https://doi.org/10.1007/s11325-020-02135-9>
- [11] Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic—A review. *Asian J Psychiatr.* 2020; 51: 102119.
doi: <https://doi.org/10.1016/j.ajp.2020.102119>
- [12] Labrague LJ. Pandemic fatigue and clinical nurses' mental health, sleep quality and job contentment during the COVID-19 pandemic: The mediating role of resilience. *J Nurs Manag.* 2021; 29(7): 1992-2001.
doi: <https://doi.org/10.1111/jonm.13383>
- [13] Perera B, Wickramarachchi B, Samanmalie C, Hettiarachchi M. Psychological experiences of healthcare professionals in Sri Lanka during COVID-19. *BMC Psychology* 2021; 9(1): 49.
doi: <https://doi.org/10.1186/s40359-021-00526-5>
- [14] Alles PS, Rohanachandra YM, Amarakoon L, Prathapan S. Psychological distress, challenges and perceived needs among doctors and nurses during the COVID-19 pandemic, in a tertiary care hospital in Sri Lanka. *Sri Lanka J Psych.* 2021; 12(1): 4-10.
doi: <https://doi.org/10.4038/sljpsyc.v12i1.8279>
- [15] Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989; 28(2): 193–213.
doi: [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- [16] Cohen S, Kamarck T, Mermelstein R. Perceived stress scale. *Measuring stress: A guide for health and social scientists* 1994; 10(2): 1-2.
- [17] Li L, Wu MS, Tao J, Wang W, He J, Liu R, et al.. A follow-up investigation of mental health among discharged COVID-19 patients in Wuhan, China. *Front Public Health.* 2021; 12(9): 640352.
doi: <https://doi.org/10.3389/fpubh.2021.640352>
- [18] Ren H, Luo X, Wang Y, Guo X, Hou H, Zhang Y, et al. Psychological responses among nurses caring for patients with COVID-19: a comparative study in China. *Transl Psychiatry.* 2021; 11(1): 1-9.
doi: <https://doi.org/10.1038/s41398-020-00993-1>
- [19] Alwaqadani N, Amer HA, Alwaqadani R, AlMansour F, Alzoman HA, Saadallah A, et al.. Psychological impact of COVID-19 pandemic on healthcare workers in Riyadh, Saudi Arabia: Perceived Stress Scale Measures. *J Epidemiol Glob Health.* 2021; 11(4): 377-388.
doi: <https://doi.org/10.1007/s44197-021-00014-4>
- [20] Qi J, Xu J, Li BZ, Huang JS, Yang Y, Zhang ZT, et al.. The evaluation of sleep disturbances for Chinese frontline medical workers under the outbreak of COVID-19. *Sleep Med.* 2020; 72: 1-4.
doi: <https://doi.org/10.1016/j.sleep.2020.05.023>

- [21] Bilgiç Ş, Çelikkalp Ü, Mısırlı C. Stress level and sleep quality of nurses during the COVID-19 pandemic. *Work* 2021; 70(4): 1021-1029.
doi: <https://doi.org/10.3233/WOR-210538>
- [22] Di Filippo P, Attanasi M, Dodi G, Porreca A, Raso M, Di Pillo S, et al. Evaluation of sleep quality and anxiety in Italian pediatric healthcare workers during the first wave of COVID-19 pandemic. *BMC Res Notes*. 2021; 14(1): 219.
doi: <https://doi.org/10.1186/s13104-021-05621-9>
- [23] Huang L, Lei W, Liu H, Hang R, Tao X, Zhan Y. Nurses' sleep quality of "fangcang" hospital in China during the COVID-19 pandemic. *Int J Ment Health Addict*. 2022; 20(2): 789-799.
doi: <https://doi.org/10.1007/s11469-020-00404-y>
- [24] Simonetti V, Durante A, Ambrosca R, Arcadi P, Graziano G, Pucciarelli G, et al.. Anxiety, sleep disorders and self-efficacy among nurses during COVID-19 pandemic: A large cross-sectional study. *J Clin Nurs*. 2021; 30(9-10): 1360-1371.
doi: <https://doi.org/10.1111/jocn.15685>
- [25] McDowall K, Murphy E, & Anderson K. The impact of shift work on sleep quality among nurses. *Occup Med*. 2017; 67(8): 621-625.
doi: <https://doi.org/10.1093/occmed/kqx152>