Sleep Quality and its Associated Factors among Nurses in a Tertiary Care Public Hospital in Puducherry District: A Cross-sectional Study

Abstract

Background: Adequate sleep is essential for human beings to maintain optimal health. Medical professionals, including nurses, work in stressful environments that could affect their sleep quality. The objective of this study was to determine the prevalence and the factors associated with poor sleep quality among nurses in a tertiary care public hospital. **Materials and Methods:** This cross-sectional analytical study was conducted on 1217 nurses aged between 21 and 60 years from May 2019 to April 2020 in a tertiary care public hospital in Puducherry. Sleep quality was assessed using the Pittsburgh sleep quality index scoring system, and the workplace stress scale was used to assess workplace stress. The Chi-squared test and adjusted Prevalence Ratio (aPR) were used to determine the factors associated with poor sleep quality. **Results:** The response rate was 99% (1217/1229), and three-fourths of the participants were women (943, 77.50%). The mean (SD) PSQI score was 4.49 (2.98), and more than one-third of participants, 42.80% (95% CI: 40.10-45.70), had poor sleep quality. The prevalence of poor sleep quality was significantly higher among women ($z = 2.33$, $p = 0.019$) aPR (95% CI): 1.08 (1.01-1.16), those having severe to dangerous levels of workplace stress ($z = 8.22$, $p > 0.001$) aPR (95% CI): 1.54 (1.39-1.71) and chronic pain ($z = 2.11$, $p = 0.016$) aPR (95% CI): 1.09 (1.02-1.17). **Conclusions:** The prevalence of poor sleep quality among the study population was high. This highlights the urgent need for implementing health promotion programs among nurses.

Keywords: *Circadian rhythm and inadequate sleep hygiene, sleep deprivations, sleep qualities, workplace stress*

Rajarajan Kayaroganam[1],
Sonali Sarkar[1],
Santhosh Satheesh[2],
Santhi Tamilmani[3],
Parthibane Sivanantham[1],
Sitanshu Sekhar Kar[1]

[1]Department of Preventive and Social Medicine (P&SM), JIPMER, Puducherry, India, [2]Department of Cardiology, JIPMER, Puducherry, India, [3]Department of Nursing Services, JIPMER, Puducherry, India

Introduction

Sleep deprivation is often considered a "public health epidemic" that has become the epicenter of many health risks.[1] Sleep is essential for nurse's well-being, and it's crucial for providing optimal job performance. Sleep quality is defined as an individual's self-satisfaction with all aspects of the sleep experience, and it is an important clinical construct measured through quantitative and qualitative methods.[2,3] Globally, the prevalence of sleep disturbances among the general population varied from 8.3% to 45%.[4] A recent meta-analysis reported that the prevalence of poor sleep quality among nursing staff worldwide was 61.0%, ranging from 32%–90% across regions.[5]

Evidence suggests that nurses who sleep less than the recommended seven hours of sleep before work hinder the quality of patient care and safety.[6] Sleep-deprived nurses are at risk of diabetes, obesity, gastrointestinal disorders, and cardiovascular diseases.[7] Shift work leads to many negative health outcomes among nurses, such as high stress levels and sleep disturbances.[8,9] Poor sleep quality affects the sleep-wake cycle and healthy body composition.[10] Other studies suggest that demographic factors (age and gender), chronic health condition, work experience, neurophysiologic conditions (emotions), family burden, and substance use negatively influence sleep quality.[11-13] Further, the Inadequate nurse-to-patient ratio in India (1.7 nurses per 1,000 population) increases nurses' workload, which in turn increases the stress, leading to sleep deprivation.[14]

Few studies in India have explored sleep quality and its association with workplace stress and chronic pain among nurses in government tertiary care hospitals. The nature of work in these hospitals is distinct

from that in secondary and primary care settings, with higher workload levels due to specialized and complex tasks. Therefore, we conducted this study to determine the prevalence and factors associated with poor sleep quality among nurses in a tertiary care public hospital in Puducherry.

Materials and Methods

This was a hospital-based cross-sectional analytical study conducted from May 2019 to April 2020 in a public tertiary care hospital in the district of Puducherry in India. The hospital had an inpatient bed capacity of 2143, and its outpatient services cater to about 8000 patients per day. The Department of Nursing Services includes 1350 nursing employees with a nurse-to-patient ratio of 1:16 to 1:40 in wards and 1:2 to 1:4 in intensive care units. The night shift of nurses involved 11 hours and 30 minutes (8 pm to 7.30 am) of duty as per institutional norms. We adopted the universal sampling (census sampling) technique in this study.

The investigator contacted participants from the working area in person. During these interactions, the investigator collected the participants' contact numbers from the duty book, and we ensured the completion of the proforma. Participants were briefed on the study's procedures, objectives, risks, benefits, expected outcomes, voluntary participation, compensation, and data confidentiality. They received a Participant Information Sheet (PIS) for reference and to clarify any queries. Subsequently, participants signed an Informed Consent Form (ICF) in the presence of a witness. After obtaining consent, the investigator marked the proforma with unique IDs and handed them to the participants. If participants were unavailable at the visit, a revisit was made up to three times, beyond which they were considered non-respondents. The required sample size for assessing the prevalence of poor sleep quality among nurses was calculated using OpenEpi (Version 3.01) based on a prevalence estimate of 43%,[15] with an absolute precision of 5%, power of 80%, and a 95% confidence interval. The initial sample size was 318. After considering a non-response rate of 10%, the final sample size was estimated to be 350. However, due to the ongoing nature of the study and the decision to use universal sampling, all 1350 nurses aged between 21 and 60 years and with at least one year of service were included during the study period. Exclusions were made for nurses on extended leave exceeding six months or who were unavailable (e.g., due to resignation, retirement, or less than one year of experience). Initially, 1229 nurses were approached for enrollment, with 12 declining to participate. Ultimately, 1217 nurses were enrolled in the study. We used a structured, pretested proforma to collect socio-demographic details (age, sex, education, marital status) and workplace characteristics (work experience, designation, workplace stress, night shift). The Pittsburgh

sleep quality index (PSQI) scale was used to assess the sleep quality and pattern of sleep during the last one month. The PSQI scale that consisted of 19 items was grouped into seven components (sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep medication, and daytime dysfunction) and each component score (0–3) was combined to get maximum global scores (0–21). A PSQI score of more than five was considered poor sleep quality.[3] This PSQI questionnaire was a valid instrument in Indian settings, and the Cronbach alpha was found to be 0.736.[16] We assessed workplace stress using workplace stress scale (WSS), consisting of eight items which describe the frequency of respondent's feelings towards his or her job. They were rated on a 5-point Likert scale that ranges from 1 to 5, yielding a maximum score of 40. Total stress score was interpreted as the following: ≤15 -relatively calm, 16 to 25 – fairly low to moderate, 26 to 40 – severe to a potentially dangerous level of stress.[17] The outcome variable was the presence or absence of poor sleep quality. Hypertension, diabetic mellitus, ischemic heart disease, stroke, chronic renal failure, and cancer were considered as chronic diseases. Chronic pain was defined as the presence of neck and lower back pain for the last one year and consulted a physician for this condition. Use of tobacco (smoke/smokeless forms) and alcohol consumption in the last thirty days and one year, respectively, was considered as current use of tobacco and alcohol, respectively. Physical inactivity was defined as spending ≤150 minutes per week for physical activity apart from work. Participants' height and weight were measured in nurses' room by the investigator in a standing position, wearing light clothing and without shoes. We used a portable stadiometer and an electronic weighing scale with precision to the nearest 0.1 cm and 100 gms, respectively. Height and weight were measured using standard guidelines to calculate their body mass index (BMI).[18] BMI was categorized into underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0 –24.9 kg/m2), and obese (≥25 kg/m^2) based on Asian cut-offs of BMI classification. Collected data were entered in Epicollect5 and were analyzed in Statistical Package for IBM Social Sciences (SPSS) version 22 (Armonk, NY: IBMCorp) and STATA 14 (StataCorp LP, College Station, TX, USA). Categorical variables were summarized as percentages, and continuous variables were reported as mean and standard deviation. Association of socio-demographic characteristics such as age, gender, education, marital status, physical inactivity, chronic pain, BMI, chronic disease, and work-related characteristics like designation, work experience, night shift per month, workplace stress with sleep quality was assessed using Pearson's Chi-squared test. Variables which were significant (≤0.20) in the univariate analysis were included in the multivariate regression model. The multivariate model was developed by keeping the poor sleep quality as dependent variable and socio-demographic

and work-related characteristics (gender, age group, workplace stress, designation, work experience, chronic pain, and number of night shifts per month) as independent variables. Adjusted prevalence ratio (aPR) was estimated using weighted forward stepwise generalized linear modeling using "Poisson's regression." In the regression model, $p \leq 0.05$ was considered statistically significant.

Ethical considerations

This study was approved by the ethical committee of the institute (No: JIP/IEC/2018/307) dated 03/10/2018. At the time of enrolment, we obtained written ICF from the study participants. We maintained data privacy and confidentiality through a password-protected computer accessible only to the researcher involved in the study.

Results

Socio-demographic and their association with poor sleep quality were summarized in Table 1. Out of the total 1229 nurses contacted, 1217 nurses completed the proforma with a 99% response rate. The mean (SD) scores of WSS and PSQI were 23.50 (5.45) and 4.49 (2.98), respectively. The participants' mean age (SD) was 36.6 (8.60) years. Obesity was present in (696, 57%) of participants. About (35, 2.90%)

and (18, 1.50%) of participants were current users of alcohol and tobacco, respectively. There was significant relationship between age ($x^2 = 6.01$, df = 1, $p = 0.014$), chronic pain ($x^2 = 6.47$, df = 1, $p = 0.011$) with poor sleep quality. Work-related characteristics and their association with poor sleep quality were summarized in Table 2. The participants mean (SD) work experience was 6 (4.10) years. Nearly one-third (400, 32.90%) of the participants had severe to dangerous levels of stress. More than half (693, 56.9%) had six or more night shifts per month. The prevalence of poor sleep quality was 42.80% (95% CI: 40.10-45.70). There was significant relationship between work experience ($x^2 = 7.23$, df = 1, $p = 0.007$), designation ($x^2 = 8.73$, df = 2, $p = 0.013$) workplace stress ($x^2 = 76.12$, df = 2, $p < 0.001$), night shift ($x^2 = 9.57$, df = 3, $p = 0.023$) with poor sleep quality. The determinants of poor sleep quality were described in Table 3. Prevalence of poor sleep quality was significantly higher among women (z = 2.33, $p = 0.019$) aPR (95% CI): 1.084 (1.013-1.160) and those having chronic pain (z = 2.11, $p = .016$) aPR (95% CI): 1.09 (1.016-1.171). Prevalence was also significantly higher among those having low to moderate workplace stress (z = 4.63, $p > 0.001$) aPR (95% CI): 1.2 (1.10-1.30) and severe to dangerous levels of workplace stress (z = 8.22, $p > .001$) aPR (95% CI): 1.5 (1.40-1.70).

Table 1: Socio-demographic characteristics of the participants and association with poor sleep quality (*n*=1217)

Variables	Total participants *n* (%)	Poor sleep quality *n* (%)	95% CI	df	χ^2	*p*
Age (in years)						
21–40 years	893 (73.37)	401 (44.90)	41.70-48.00	1	6.01	0.014*
41–60 years	324 (26.62)	120 (37.03)	31.80-42.30			
Education						
Diploma (Nursing)	386 (31.71)	154 (39.89)	35.00-44.60	2	2.19	0.331
*B.Sc (Nursing)	680 (55.87)	303 (44.55)	41.00-48.40			
**M.Sc (Nursing) and above	151 (12.40)	64 (42.38)	34.40-50.30			
Gender						
Men	274 (22.51)	105 (38.32)	32.50-43.80	1	2.91	0.088
Women	943 (77.49)	416 (44.11)	40.70-47.30			
Body mass index						
Underweight	21 (1.72)	10 (47.61)	28.60-71.40	3	5.73	0.125
Normal	250 (20.54)	102 (40.80)	34.80-46.40			
Overweight	250 (20.54)	93 (37.20)	31.60-43.20			
Obese	696 (57.18)	316 (45.40)	41.40-49.10			
Physical inactivity						
No	312 (25.63)	123 (39.42)	33.70-45.20	1	1.96	0.161
Yes	905 (74.37)	398 (43.97)	40.90-47.10			
Chronic disease						
Yes	317 (26.04)	145 (45.74)	40.10-50.80	1	1.50	0.220
No	900 (73.96)	376 (41.77)	38.30-45.30			
Chronic pain						
Yes	222 (18.24)	112 (50.45)	44.10-56.80	1	6.47	0.011*
No	995 (81.76)	409 (41.10)	38.20-44.20			
Marital status						
Married	231 (84.30)	862 (91.40)	1093 (89.80)	1	2.25	0.139
Unmarried and others	43 (15.70)	81 (8.60)	124 (11.20)			

*Significant: *p*≤0.05; **B.Sc=Bachelor of science; ***M.Sc=Master of science

Table 2: Work-related characteristics of the participants and association with poor sleep quality (*n*=1217)

Variables	Total participants *n* (%)	Poor sleep quality *n* (%)	95% CI	df	χ²	*p*
Work experience						
≤10 years	811 (66.63)	369 (45.49)	42.00-48.80	1	7.23	0.007*
>10 years	406 (33.36)	152 (37.43)	33.00-42.60			
Department						
Emergency	111 (9.12)	47 (42.34)	33.30-51.40	4	0.63	0.960
Operating room	154 (12.65)	66 (42.85)	35.10-50.60			
General ward	579 (47.32)	249 (43.00)	39.00-46.60			
Intensive care unit	269 (22.10)	118 (43.86)	37.90-50.20			
Outpatient department	104 (8.54)	41 (39.42)	29.80-49.00			
Designation						
Nursing officer	834 (68.52)	377 (45.20)	41.70-48.70	2	8.73	0.013*
SNO and PHN**	317 (26.04)	125 (39.43)	33.80-44.80			
ANS and above***	66 (5.42)	19 (28.78)	18.20-40.90			
Workplace stress						
Calm	68 (5.58)	10 (14.70)	7.40-23.50	2	76.12	0.001*
Low to moderate	749 (61.54)	275 (36.71)	33.40-40.30			
Severe to dangerous	400 (32.86)	236 (59.00)	54.30-64.00			
Number of night shift per month						
0	36 (2.95)	10 (27.77)	13.90-44.40	3	9.57	0.023*
1	378 (31.10)	144 (38.09)	33.10-42.90			
3	110 (9.03)	49 (44.54)	34.50-53.60			
>6	693 (56.94)	318 (45.88)	42.30-49.80			

*Significant: *p*≤0.05, **SNO=Senior nursing officer, PHN=Public health nurse, ***ANS=Assistant nursing superintendent

Discussion

In this study, more than two-thirds of participants had poor sleep quality 42.8% (95% CI: 40.1-45.7). This prevalence was higher when compared to nurses working in a private medical college (39%) in Chennai but lower than studies conducted in a private multispecialty hospital (70%) at Hyderabad and two private medical colleges (46%) of Vishakhapatnam and Belgaum.[19-21] Meanwhile, a similar prevalence of poor sleep quality (43%) was reported in Manipur public tertiary care hospital.[15] The high prevalence of poor sleep quality in the study could be due to inadequate nurse-to-patient ratio (1:16 to 1:40 in wards and 1:3 to 1:4 in ICUs, particularly during evening and night shifts, frequent night duties, and high patient turnover in this hospital. A recent meta-analysis reported that the prevalence of poor sleep quality among nurses worldwide was 61% (95% CI: 55.8-66.1%).[5] The difference in the prevalence across studies could be due to differences in the cut-off levels of PSQI, different scales of sleep measurement, stress levels at work, cultural differences, and healthcare delivery systems across study settings. In this study, the prevalence of poor sleep quality was significantly higher among women than men which was consistent with the Chinese study.[22] The reason could be most participants were young and held additional responsibilities of child-rearing and family responsibility, compared to male nurses. This could have contributed to the observed higher prevalence of poor sleep quality among women. To improve sleep quality

among women nurses, education on sleep hygiene could improve sleep-wake cycle.[23] The prevalence of poor sleep quality was significantly higher among those having low to moderate and severe to dangerous levels of workplace stress. This was consistent with other studies from China and India.[24,25] The reason for the considerably higher level of workplace stress observed in this study could be due to shortage of nurses, high work pressure in certain departments, and high patient turnover in public tertiary care hospitals in the country. Considering the inverse relationship of workplace stress and sleep quality, nurse administrators and hospital management shall help in creating a stress-free work environment.[26] The prevalence of poor sleep quality was significantly higher among participants with the presence of chronic pain, which was consistent with another study.[27] This hospital nurse's job often involves more than 10 hours of duties, leading to neck and low back pain that has profoundly influences on sleep quality. Other studies also identified that musculoskeletal pain decreases sleep quality and psychological factors play a mediating role in pain intensity and sleep disturbance.[28] Cognitive behavior therapy could be the ideal strategy to mitigate poor sleep for those comorbid with chronic pain.[29] In this study, poor sleep quality was not significantly higher among night-shift participants. This finding contradicts several other studies that reported shift work, especially the night shifts, to adversely affect on sleep quality.[30] The possible reason could be due to day off policy or

Table 3: Determinants of poor sleep quality (*n*=1217)

Variables	Poor sleep quality		Adjusted PR## (95% CI)#	Z	p
	Yes *n* (%)	No *n* (%)			
Age category (in years)					
21-40	401 (44.90)	492 (55.10)	1		
40-60	120 (37.03)	204 (62.97)	1.00 (0.91-1.10)	0.08	0.933
Gender					
Men	105 (38.32)	169 (61.68)	1		
Women	416 (44.11)	527 (55.89)	1.08 (1.01-1.16)	2.33	0.019*
Night shift per month					
0	10 (27.77)	26 (72.23)	1		
1	144 (38.09)	234 (61.91)	1.07 (0.91-1.26)	0.81	0.412
3	49 (44.54)	61 (55.46)	1.16 (0.93-1.45)	1.31	0.185
≥6	318 (45.88)	375 (54.12)	1.13 (0.92-1.39)	1.16	0.242
Designation					
ANS and above***	19 (28.78)	47 (71.21)	1		
SNO and PHN**	125 (39.43)	192 (60.57)	1.10 (0.98-1.25)	1.65	0.101
Nursing officer	377 (45.20)	457 (54.79)	1.03 (0.82-1.29)	0.27	0.797
Workplace stress					
Calm	10 (14.70)	58 (85.30)	1		
Low to moderate level	275 (36.71)	474 (63.29)	1.25 (1.13-1.37)	4.63	0.001*
Severe to dangerous level	236 (59.00)	164 (41.00)	1.54 (1.391-1.71)	8.22	0.001*
Work experience					
>10 years	152 (37.43)	254 (62.57)	1		
≤10 years	369 (45.49)	442 (54.51)	1.03 (0.93-1.15)	0.63	0.532
Chronic pain					
No	409 (41.11)	586 (58.89)	1		
Yes	112 (50.45)	110 (49.55)	1.09 (1.02-1.17)	2.11	0.016*

SNO=Senior nursing officer PHN=Public health nurse;*ANS=Assistant nursing superintendent. *Significant results: $p \leq 0.05$, #CI=Confidence interval; ##PR=Prevalence ratio

duty roaster practice for those completing night duty that allows them to take two days off followed by night shift. This policy/practice allowed nurses to rest adequately after continuous night duties which would have helped them to recover. Specific strategies at the individual level can address poor sleep quality by healthy dietary profile, aerobic exercise, good sleep habits, cognitive behavior therapy, and melatonin administration.[29,31] At the institutional level, alcohol and smoke-free policy, addressing staff shortage, mandatory health screening, policy on relievers (extra staff) in busy areas, nap break of 15–30 minutes, preventing bright light exposure, and shift schedule rearrangement and crisis helpline could be a crucial step in improving sleep quality among the nurses.[31]

This study was conducted in a single tertiary care hospital, so the findings cannot be generalized to other type of hospitals. Measurement of sleep quality was done through self-report of participants which could carry social-desirability bias. Information on the quality of sleep relied on participants' recall of their experiences over the past month, which might have introduced recall bias in the study findings. Being a cross-sectional study, cause-effect relationships to poor sleep quality could not be established.

Conclusion

The prevalence of poor sleep quality was considerably high among nurses in this study. It is necessary to initiate measures to mitigate the level of stress in the workplace through stress reduction techniques and promoting recreational activities among nurses. Administrators need to encourage proper sleep hygiene measures and other general measures (evidence-based schedule rearrangement, overtime reduction, nap break of 15–30 minutes, and adequate manpower resources) particularly targeted towards women and those having below ten years of work experience.

Conflicts of interest

Nothing to declare.

References

1. Chattu VK, Manzar MD, Kumary S, Burman D, Spence DW, Pandi-Perumal SR. The global problem of insufficient sleep and its serious public health implications. Healthcare 2019;7. doi: 10.3390/healthcare7010001.
2. Nelson KL, Davis JE, Corbett CF. Sleep quality: An evolutionary concept analysis. Nurs Forum 2022;57:144-51.
3. 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;28:193–213.
4. Qiu D, Yu Y, Li RQ, Li YL, Xiao SY. Prevalence of sleep disturbances in Chinese healthcare professionals: A systematic review and meta-analysis. Sleep Med 2020;67:258–66.
5. Zeng LN, Yang Y, Wang C, Li XH, Xiang YF, Hall BJ, *et al*. Prevalence of poor sleep quality in nursing staff: A meta-analysis of observational studies. Behavioral Sleep Med 2020;18:746–59.
6. Stimpfel AW, Fatehi F, Kovner C. Nurses' sleep, work hours, and patient care quality, and safety. Sleep Health 2020;6:314–20.
7. Sison JM. The effects of sleep deprivation among nurses. Int J Adv Res Publ 2022;5:34-52.
8. Malak MZ, Al-Amer RM, Abu Adas MH. The influence of shift-work on perceived stress, sleep quality, and body mass index among emergency nurses. J Hum Behav Soc Environ 2023;33:779-92.
9. Al-Hrinat J, Al-Ansi AM, Hendi A, Adwan G, Hazaimeh M. The impact of night shift stress and sleep disturbance on nurses' quality of life: Case in Palestine Red Crescent and Al-Ahli Hospital. BMC Nurs 2024;23:24.
10. Chang WP, Yang CM. Influence of sleep-wake cycle on body mass index in female shift-working nurses with sleep quality as mediating variable. Ind Health 2020;58:161–9.
11. Peiqing Z, Guanqing F. Factors Influencing Sleep Quality Among Nurses. [China]: University of Gavle and Lishui; 2018.
12. Van Nguyen T, Liu HE. A cross-sectional study on sleep disturbances and associated factors among nurses. BMC Psychiatry 2022;22:119.
13. Neale J, Meadows R, Nettleton S, Panebianco D, Strang J, Vitoratou S, *et al*. Substance use, sleep and intervention design: Insights from qualitative data. J Mental Health 2019;28:482–9.
14. Team CM. India's shortage of doctors, nurses may hamper COVID19 response. Indiaspend. 2020. Available from: https://www.indiaspend.com/indias-shortage-of-doctors-nurses-may-hamper-covid19-response/. [Last accessed on 2021 Nov 01].
15. Christina S, Konjengbam S. Sleep quality among nurses in a tertiary hospital in Manipur. J Med Soc 2019;33:146-51.
16. Manzar MD, Moiz JA, Zannat W, Spence DW, Pandi-Perumal SR, BaHammam AS, *et al*. Validity of the Pittsburgh sleep quality index in Indian university students. Oman Med J 2015;30:193–202.
17. Marlin Company and the American Institute of Stress. The Workplace Stress Scale: Attitudes in the American Workplace VII. 2009. Available form: https://www.stress.org/wp-content/uploads/2024/06/The-Workplace-Stress-Scale-2024.pdf. [Last accessed on 2024 May 01].
18. World Health Organization. WHO STEPS Surveillance Manual: STEPwise Approach to Non Communicable Disease Risk Factors Surveillance. Geneva: World Health Organization; 2017. p. 7–1–5. [Last accessed on 2020 Jun 02].
19. Jotheeswari1 SV. Assessment of quality of sleep in nurses: A cross sectional study. Int J Physiol 2020;8:69–72.
20. Joseph A, Brooke SM, Jelby P, Sharon S. The prevalence of shift work sleep disorder and the quality of sleep among nurses working in selected Hospitals, Hyderabad. Indian J Psychiatr Nurs 2018;15:10.
21. Khade Y, Behera S, R P, Korradi S. Study of insomnia, day time sleepiness and sleep quality among south Indian nurses. J Clin Diagn Res 2018;12:CC09–12.
22. Dong H, Zhang Q, Sun Z, Sang F, Xu Y. Sleep disturbances among Chinese clinical nurses in general hospitals and its influencing factors. BMC Psychiatry 2017;17:241.
23. Yazdi Z, Jalilolghadr S, Tootoonchian F. Effect of a sleep hygiene education program on sleep problems in female nurses on shift work. J Sleep Sci 2017;2:28–33.
24. Deng X, Liu X, Fang R. Evaluation of the correlation between job stress and sleep quality in community nurses. Medicine (Baltimore) 2020;99:e18822.
25. Kaushik A, Ravikiran SR, Suprasanna K, Nayak MG, Baliga K, Acharya SD. Depression, anxiety, stress and workplace stressors among nurses in tertiary health care settings. Indian J Occup Environ Med 2021;25:27-32.
26. Godwin A, Alex L, Suuk E, Selorm FH. Occupational stress and its management among nurses at St. Dominic Hospital, Akwatia, Ghana. Health Sci J 2016;10. doi: 10.21767/1791-809X.1000467.
27. Liu H, Liu J, Chen M, Tan X, Zheng T, Kang Z, *et al*. Sleep problems of healthcare workers in tertiary hospital and influencing factors identified through a multilevel analysis: A cross-sectional study in China. BMJ Open 2019;9:e032239.
28. Whibley D, Alkandari N, Kristensen K, Barnish M, Rzewuska M, Druce KL, *et al*. Sleep and pain: A systematic review of studies of mediation. Clin J Pain 2019;35:544-8.
29. Wiklund T, Linton SJ, Alföldi P, Gerdle B. Is sleep disturbance in patients with chronic pain affected by physical exercise or ACT-based stress management? – A randomized controlled study. BMC Musculoskelet Disord 2018;19:111.
30. McDowall K, Murphy E, Anderson K. The impact of shift work on sleep quality among nurses. Occup Med (Lond) 2017;67:621–5.
31. Sun Q, Ji X, Zhou W, Liu J. Sleep problems in shift nurses: A brief review and recommendations at both individual and institutional levels. J Nurs Manag 2019;27:10–8.