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ORIGINAL ARTICLE

Shift Changes' Effects on Sleep Quality and Work Performance among Nurses Working in Bahrain's Intensive Care Units

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ABSTRACT

Objective: To determine the difference in the sleep quality and work performance of nurses between one shift duty, two shifts duty, and three shifts duty in intensive care units at a government hospital in the Kingdom of Bahrain.

Methods: This cross-sectional study was conducted at a government hospital of Bahrain from February to April 2021. A total of 200 nurses worked for at least one year in an intensive care units were eligible for the study. A questionnaire was administered online to collect data. The Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality while Nurse Work Function Questionnaire (NWFQ) was used to measure work performance.

Results: There were 145 (72.5%) females and 55 (27.5%) males with a mean age of 38.2 ± 8.2 years. Most of the nurses were staff nurses 188 (94%), and shift workers 178 (89%). The mean PSQI of nurses who work only one shift reported normal sleep quality of 1.3 ± 1.0 where those who work two shifts had poorer sleep quality measured 9.2 ± 0.8 and nurses who work three shifts had reported even worse sleep quality with a statistically significant difference 15.6 ± 1.8 (p-value <0.0001). Moreover, the more variety of shifts the critical care nurses work, the more impaired their performance was (p-value <0.001).

Conclusion: The more shift work schedules the nurse works, the worse is the reported sleep quality and work performance.

Keywords: Critical Care Nursing, Shift Work Schedule, Sleep Quality, Work Performance.

INTRODUCTION

Nursing is a stressful and physically demanding professional; add to it impaired sleep quality due to consecutive shift work.[1] Literature review described shift work as a heavy burden, work hazards, and the most common reason for the poor sleep quality of nurses; for the psychological, physical, spirit, and work performance complications that followed it.[2] Shift work produces chronic and increased fatigue by reducing both sleep quantity and quality.[3] A system of irregular rotating shift works can disturb nurses' circadian rhythm and motive sleep deprivation.[4] Therefore, the sleep debt (sleep loss) can only be restored during their nonworking days.[5]

Additionally, shift-working nurses appeared to have poorer work performance than non-shift workers, sleep loss significantly affected decision making, initiative, integration of information, high-attention tasks, planning and plan execution, and vigilance.[6,7] Apart from the effects of current shift work, various literature review stated that even those who had previously done shift work were substantially more likely to have poor sleep quality than those who had never done shift work.[8]

The extent to which shiftwork nurses are influenced by sleep deprivation is alarming; during working years that eventually can lead to errors and unsafe patient care.[9] Therefore, it is critical to address poor sleep quality in nursing as they are at high risk of sleep deprivation and making errors that affect patient care and safety.[3]

Although Bahrain has a considerable workforce of competent and well-trained nurses, there is a gap in our knowledge regarding the sleep quality of shift-work nurses and how it affects work performance of the shift-work nurses. This study was therefore conducted to evaluate the sleep quality and work performance of shift-work critical care nurses in intensive care units in Bahrain.

METHODS

A descriptive cross-sectional study was conducted in a

critical care setting of a government hospital in Bahrain from February to April 2021 to investigate the impact of shiftwork on critical care nurses' sleep quality and work performance. Ethical clearance was obtained from the Institutional Review Board (IRB) of Collage of Health and Sport Sciences, Bahrain. Reference Number is 3/2020-21 dt. October 1,2020. Also, from Ministry of Health (MOH), Bahrain. Reference Number is AURS/ 358/ 2020. Participants were asked to consent, and the purpose and specifics of the study were described. No form of personal identification was incorporated into the survey; therefore, confidentiality and anonymity of the respondents was guaranteed.

The study population consisted of 400 nurses working in a critical care setting of government hospital in Bahrain. Of these 400 nurses, the study sample constituted 200 (50%) randomized nurses who voluntarily participated and were not on (sick) leave while the study was conducted. The hospital where the study was conducted had five main critical care settings and the nurses worked for 48 hours a week in three different shifts (morning 6:30 am to 2:30pm, evening 2:30pm to 10:30 pm, and night 10:30 pm to 6:30 am). The supervisor nurses worked from 6:30 a.m. to 2:30 p.m.

An online questionnaire was designed and reviewed to collect nurses reported information. It consisted of three parts to achieve the aim of study.

(1) Sociodemographic Characteristics Questionnaire: includes age, gender, level of education, marital status, and number of children while work related variables includes years of experience, area of practice, position, shifts pattern (fixed duty or two shifts duty morning/ evening or three shifts duty morning/evening/night. The form was developed by the researcher and in consultation with two academic supervisors. The validity of the sample characteristics form done by consultation with an academic supervisor. Since demographic characteristics represent relatively simple constructs, the validity establishing is more straightforward.

(2) The Pittsburgh Sleep Quality Index (PSQI): includes subjective self – rated items to elevate sleep quality and has been commonly used in sleep literature.[10] The PSQI comprise eighteen items across seven factors of sleep quality which include: Subjective sleep quality (one item), Sleep latency (four items), Sleep duration (one item), Sleep efficiency (four items), Sleep disturbance (one item), Daytime dysfunction (one item), and Use of sleeping medications (four items). [10] The total of all factors provides the measure for overall sleep quality. Scores range from 0 (good sleep) – 21 (poor sleep), and 5 indicate poor sleep quality. Its validity was checked based on subjects in three groups: good sleepers, poor sleepers, and disordered sleepers.[10]The internal consistence (Cronbach's) was 0.83 for total score, and test – retest reliability correlation coefficient was 0.85 for total score and 0.65 to 0.84 for each domain, [10] and 0.921 with all scale's components showed very high affinity to the scale reflected by moderate to high item-total correlation that ranged from 0.71 to 0.98 in this study.

(3) The Nurses Work Functioning Questionnaire (NWFQ): includes subjective self–rated items to elevate impairments in work functioning due to common mental disorders in health care workers during previous 4 weeks, and the worker chooses a response on a Likert scale of between 5 and 7 categories.[11] The NWFQ enclose a 50-items self-report questionnaire consisting of seven subscales: cognitive aspects of task execution (11 items), impaired decision making (3 items), causing incidents at work (8 items), avoidance behavior (8 items), conflicts and irritations with colleagues (7 items), impaired contact with patients and their family (8 items), and lack of energy and motivation (5 items).[11] The total of all factors provides the measure for overall job performance with standard sum score ranges from (1 to 100) to calculate final total score.[11] Scores range from 'totally disagree' to 'totally agree' with it. Relation (e.g., 'almost never' to 'almost always') and total frequencies (e.g., 'not once' to 'more than once a day'), and an additional option to record that the statement 'does not apply to my job are also included.[11] Overall reliability and convergent validity were satisfactory for six of the subscales except one subscale (impaired decision making) lacked reproducibility and validity and required additional work before use.[11]Therefore, in this study, researcher included all subscales except impaired decision-making scale. In this study, the NWFQ subscales showed excellent reliability according to the Cronbach's alpha measure of internal consistency except for the avoidance behavior subscale which recorded acceptable reliability. Their reliability index ranged from as low as 0.777 for the avoidance subscale to as high as 0.933 for the cognitive aspect. All subscales' items showed very high affinity to their respective scale reflected by moderate to high item-total correlation that ranged from 0.43 to 0.91.

Data entry and analysis were performed using a Statistical Package for Social Sciences (SPSS) version 20.0. Mean ± SD were computed for quantitative variables like, age (years), PSQI score and NWFQ score while frequency and percentages were computed for categorical variables like gender, education level, marital status, having children, area of practice,

designation, experience, and shift schedule. Inferential statistics were explored using Independent t-test and One-way ANOVA to compare mean difference of PSQI and NWFQ score with demographic and clinical characteristics of the participants. The p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Of 200 critical care nurse respondents the mean age was 38.2 ± 8.2. There were 145 (72.5%) females and 55 (27.5%) males. Majority of the participants were married 157 (78.5%), having children 138 (86.2%), had graduated with bachelor's degree 142 (71%), working in intensive care unit (ICU) 80 (4.0%) and neonatal intensive care unit (NICU) 74 (37.0%) department, and having working experience 6 to 10 years 87 (43.5%). Most of the nurses were staff nurses 188 (94%), and shift workers 178 (89%), including one shift duty (none-shift duty) 22 (11%), two shift duty 14 (7%), and the three-shift duty 164 (82%). (Table 1)

The mean PSQI score was found significantly lower in master's degree holder nurses 8.4 ± 6.4 as compared to diploma 12.6 ± 4.2 and bachelor's degree holder 14.0 ± 4.8 (p-value 0.005). Similarly, the mean NWFQ score was found significantly lower in master's degree holder nurses 26.7 ± 20.4 as compared to diploma 49.7 ± 16.1 and bachelor's degree holder 58.8 ± 22.6 (p-value <0.001). Nurses working as a supervisor showed lowest mean PSQI score 2.7 ± 3.5 as compared to head nurses 4.3 ± 4.9 and staff nurses 14.3 ± 4.1 (p-value <0.001). Similar findings were found in NWFQ score. (Table 2)

The mean PSQI of nurses who work only one shift reported normal sleep quality of 1.3 ± 1.0 where those who work two shifts had poorer sleep quality measured 9.2 ± 0.8 and nurses who work three shifts had reported even worse sleep quality with a statistically significant difference 15.6 ± 1.8 (p-value <0.0001). The nurse work functioning questionnaire had an overall mean (SD) of 56.3 ± 22.5. Interestingly, the more variety of shifts the participants work, the higher the impaired work functions they suffer (p-value <0.001). In table 3 we stratified shift work on the basis of education level and designation because these two variables were found significant in both PSQI and NWFQ. After stratification the findings showed statistically significant mean difference in both PSQI and NWFQ score (p-value ≤ 0.05) except head nurse PSQI score (p-value 0.065).

DISCUSSION

Little is known about the impact of shift work on sleep quality and work performance in Bahraini nursing literature today. The key finding of this study was working shifts was an independent risk factor for sleep deprivation and decreasing work performance. The timely, efficient, and safe delivery of patient care depends on shiftwork.[5] However, shift work-related sleep deprivation may severely lower nurse performance.

Sleep difficulties among nurses, including insufficient sleep, disturbed sleep pattern, thus poor sleep quality, are widely prevalent.[12] The literature reports a significant number of nurses had compromised sleep quality, particularly shift work nurses had a high degree of sleep deficiency and the night nurses had especially lower sleep quality comparing to another shift.[5,12-18]

In fact, it was estimated that up to 85% of shift work nurses suffer from poor sleep quality[19] similar to our study of 89%, and, consequently, up to 61.0% sever from sleep deprivation.[20] According to Shokey *et al.*, (2017), healthcare practitioners represent two of the five occupational groups with the highest prevalence of poor sleep quality and short sleep duration.[21] The extent to which shiftwork nurse are influenced by sleep deprivation is alarming; during working years that eventually can lead to errors and unsafe patient care.[22] Therefore, it is critical to address poor sleep quality in nursing as they are at high risk of sleep deprivation and making errors that affect patient care and safety.

Poor sleep quality and the following factors were statistically significantly correlated among shift-work critical care nurses: experience, education level, marital status, designation, and gender. In support, numerous studies have presented gender differences are associated with disturbed sleep – wake cycle, and poor sleep quality.[23] A study done by van de Langenberg *et al.*, (2016) indicated that female nurses had poorer sleep quality in all shift types.[24] The complaints about sleep problems increased with female gender and married nurses may be because of their physiological differences and taking care of the family members. Nurses with master's degrees were more likely to have good sleep quality and work performance than nurses with diploma and bachelor's degrees. As opposed to that, Omar *et al.*, 2022 found that nurses with higher educational level experienced poor sleep and work quality.[25] Although the studies suggests that nurses who continue postgraduate education have improved critical thinking, decision-making skills, and leadership qualities that enable them to confront inferior practice, and the competences required for advanced clinical practice roles.[2] This study found that having more work experience of at least 10 years may be connected with

Table 1: Sociodemographic and clinical characteristics of the critical care nurse participants (n=200)

Age Group (Years)	**n (%)**
21-30	41 (20.5)
31-40	74 (37.0)
41-50	73 (36.5)
51-65	12 (6.0)
Gender	
Male	55 (27.5)
Female	145 (72.5)
Marital Status	
Single	40 (20.0)
Married	157 (78.5)
Divorced/Separated	3 (1.5)
Having Children (n= 160) [$]	
Without	22 (13.8)
With	138 (86.2)
Education Level	
Diploma	31 (15.5)
Bachelor	162 (81.0)
Master	7 (3.5)
Area of Practice	
Burns unit	10 (5.0)
CCU	27 (13.5)
ICU	80 (40.0)
NICU	74 (37.0)
PICU	9 (4.5)
Length of Clinical Experience (Years)	
≤ 5	52 (26.0)
6 to 10	87 (43.5)
> 10	61 (30.5)
Designation	
RN	188 (94.0)
Supervisor	9 (4.5)
Head Nurse	3 (1.5)
Work Shifts Schedule	
One Shift	22 (11.0)
Two Shifts	14 (7.0)
Three Shifts	164 (82.0)

- CCU: Critical Care Unit, ICU: Intensive Care Unit, NICU, Neonatal Intensive Care Unit, PICU: Pediatric Intensive Care Unit, RN: Registered Nurses

[$] Only 160 individuals who ever married were included, All data presented as number (%)

Table 2: Mean comparison of PSQI and NWFQ with demographic and clinical characteristics of the critical care nurse participants (n=200)

Characteristics	PSQI		NWFQ	
	Mean ± SD	p-value	Mean ± SD	p-value
Age Group (Years)				
21-30	13.1 ± 5.1	0.347~	57.8 ± 25.7	0.766~
31-40	13.0 ± 5.4		57.7 ± 26.0	
41-50	14.4 ± 4.4		54.3 ± 17.0	
51-65	13.6 ± 2.7		53.8 ± 17.7	
Gender				
Male	12.4 ± 6.2	0.034^	52.8 ± 27.8	0.181^
Female	14.0 ± 4.2		57.6 ± 20.1	
Marital Status				
Single	11.7 ± 6.2	0.020~*	51.6 ± 30.7	0.344~
Married	14.1 ± 4.4		57.4 ± 19.9	
Divorced/Separated	12.6 ± 4.0		55.7 ± 24.6	
Having Children (n= 160) $				
Without	13.9 ± 4.6	0.817^	51.9 ± 18.0	0.134^
With	14.1 ± 4.3		58.0 ± 20.31	
Education Level				
Diploma	12.6 ± 4.2	0.005~*	49.7 ± 16.1	<0.001~*
Bachelor	14.0 ± 4.8		58.8 ± 22.6	
Master	8.4 ± 6.4		26.7 ± 20.4	
Area of Practice				
Burns unit	12.9 ± 6.5	0.655~	47.9 ± 20.8	0.012~*
CCU	12.7 ± 4.7		49.3 ± 16.4	
ICU	13.8 ± 4.9		62.8 ± 27.2	
NICU	13.6 ± 5.0		52.6 ± 18.2	
PICU	15.4 ± 2.6		57.6 ± 11.2	
Length of Clinical Experience (Years)				
≤ 5	14.2 ± 4.3	<0.001~*	60.1 ± 20.0	0.356~
6 to 10	12.0 ± 5.7		54.5 ± 28.8	
> 10	15.4 ± 3.2		55.5 ± 11.7	
Designation				
RN	14.3 ± 4.1	<0.001~*	58.9 ± 20.2	<0.001~*
Supervisor	2.7 ± 3.5		11.6 ± 10.7	
Head Nurse	4.3 ± 4.9		24.8 ± 27.2	

- CCU: Critical Care Unit, ICU: Intensive Care Unit, NICU, Neonatal Intensive Care Unit, PICU: Pediatric Intensive Care Unit, RN: Registered Nurses, PSQI: Pittsburgh Sleep Quality Index, NWFQ: Nurses Work Functioning Questionnaire, $ Only 160 individuals who were ever married were included

^Independent Sample t -test, ~One-Way ANOVA, *p-value ≤ 0.05

Table 3: Mean comparison of PSQI and NWFQ with working shift of the critical care nurse participants stratified with education level and designation (n=200)

Characteristics	PSQI		NWFQ	
	Mean ± SD	p-value	Mean ± SD	p-value
Work Shift (Overall)				
One Shift	1.3 ± 1.0	<0.001~*	9.2 ± 5.1	<0.001~*
Two Shifts	9.2 ± 0.8		33.5 ± 11.8	
Three Shifts	15.6 ± 1.8		64.5 ± 13.9	
Education Level				
Diploma (n=31)				
One Shift	1.0 ± 0.1	0.001~*	9.4 ± 0.6	<0.001~*
Two Shifts	8.0 ± 0.1		26.2 ± 6.8	
Three Shifts	14.3 ± 1.1		56.1 ± 5.4	
Bachelor (n=162)				
One Shift	1.4 ± 1.1	0.001~*	9.7 ± 5.4	0.001~*
Two Shifts	9.5 ± 0.9		37.3 ± 12.8	
Three Shifts	15.8 ± 1.7		66.1 ± 14.5	
Master (n=7)				
One Shift	1.0 ± 0.1	0.001~*	4.4 ± 6.3	0.025~*
Two Shifts	9.2 ± 0.5		29.6 ± 10.9	
Three Shifts	20.0 ± 0.1		59.8 ± 0.1	
Designation				
RN (n=188)				
One Shift	1.5 ± 1.1	0.001~*	10.4 ± 5.2	0.001~*
Two Shifts	9.1 ± 0.9		32.4 ± 11.1	
Three Shifts	15.6 ± 1.8		65.5 ± 13.9	
Supervisor (n=9)				
One Shift	1.0 ± 0.81	0.001~*	6.8 ± 5.4	0.001^*
Two Shifts	9.0 ± 0.1		28.4 ± 3.7	
Head Nurse (n=3)				
One Shift	1.5 ± 0.7	0.065^	9.1 ± 1.1	0.019^*
Two Shifts	10.0 ± 0.1		56.3 ± 0.1	

-RN: Registered Nurses, PSQI: Pittsburgh Sleep Quality Index, NWFQ: Nurses Work Functioning Questionnaire

^Independent Sample t-test, ~One -Way ANOVA, *p-value ≤ 0.05

better sleep quality in line with study done in Egypt.[25] However, a longer history of shift work was linked to poorer sleep quality,[3] and older age quality is connected to a decline in sleep quality as well as a gradual shortening of sleep quantity.[26]

Additionally, both nursing supervisors and head nurses reported significantly better sleep quality than the registered nurses, which previous studies have not found any association between them. One possible explanation for this disparity is because nursing supervisors and head nurses are more likely to work one shift duty, mostly morning duty. Varies studies have established that nurses with a morning type had better sleep quality between morning shifts,[5] while evening type was associated with irregular sleep and frequent awake during their sleep,[12] leading to insufficient sleep duration and poor sleep quality.[20]

In this study, it was observed that nurses holding bachelors degree, working in intensive care unit, and registered nurses reported significantly higher impaired work performance. This is in line with the finding of Momeni *et al.,* which reported that the majority of ICU registered nurses had moderate 66.1% to 27.2% low quality of work life.[27] This may directly to ICU can be an extremely stressful environment and demanding high nursing care, and the possible factors for the difference are that registered nurses have shiftwork, direct contact with patients and their families, high workload, and high work stress than non-shift nurses.[28]

Shift work nurses have an impaired ability to quickly and correctly perform mental calculations compared to those who work in fixed shifts.[6] Shortened sleep quantity and poor sleep quality has been shown to decrease cognitive capabilities like attention span, concentration, and reaction time.[27] Univariate analyses have been made and observed that medication errors occur more frequently during occasional night shifts.[16] Hence shift work force poor sleep quality directly lead to decreased work performance of nurses.[28]

The strengths of this research are representative sample size selected through random sampling technique to eliminate sampling bias, and this is the first that examine impact of shiftwork on sleep quality and work performance among critical care nurses in Bahrain. However, the limitation of a questionnaire-based tool study is that the information that will be gathered may be influenced by subject's response bias because of the self-reporting nature of the questionnaire.

This study provides the baseline (ground) data for attention of researchers and administrate to provide satisfactory work conditions with minimum complication of sleep among critical care nurses, by implement a policy to screen for sleep quality at each required yearly fitness check-up at occupation health clinic especially shift worker. Moreover, integrate sleep hygiene practices among nursing students to prepare them to shift – working duty from the beginning.

CONCLUSION

This study has found that there is a significant prevalence of poor sleep quality and impaired work performance among shift work critical care nurses. To help these nurses, hospitals institutions should be aware of sleep disturbance, work performance, and the risk of shift work. Strategic and organizational objectives should also be taken into consideration when implementing interventions connected to shiftwork, sleep hygiene-related interventions, and improving work environment rather than only relying solely on an assessment.

ETHICAL APPROVAL: The ethical clearance was obtained from the Institutional Review Board of Collage of Health and Sport Sciences, Bahrain (Ref. No: 3/2020-21, dated October 01, 2020). Also from the Ministry of Health, Bahrain (Ref. No. AURS/358/2020, dated: Nov 11, 2020).

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