EFFECT OF SLEEP QUALITY ON BLOOD PRESSURE AND HEART RATE AMONG SHIFT NURSES IN A PUBLIC HOSPITAL IN BANGKOK, THAILAND

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ABSTRACT:

Background: A shift work has often associated with poor sleep quality which is a risk factor of cardiovascular disease. This study investigated whether sleep quality is associated with vital signs among shift nurses in a public hospital.

Method: A cross-sectional survey of 270 shift nurses in a public hospital in Bangkok, Thailand, was conducted using self-report questionnaire. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). The vital signs; blood pressure and heart rate was measured form nurses followed by WHO recommended procedure. Chi-square tests and multivariate linear regression models were performed to find significant associations.

Results: Among 270 shift nurses, 100 (37%) of them were classified as poor sleep quality (PSQI > 10). The results indicated that sleep quality was not associated with systolic blood pressure (p=0.87), diastolic blood pressure (p=0.17), heart rate (p=0.58). After adjustment for age, gender, BMI, exercise, caffeine consumption and alcohol consumption, an increased one score of PSQI was tented to increase 0.33 mmHg of systolic blood pressure (β = 0.33, *p*-value = 0.30), however, statistical significant was not achieved. It could be suggested that poor sleep quality was associated with an increasing of systolic blood pressure.

Conclusions: More than half of shift nurses reported poor sleep quality, however, there was no association with blood pressure and heart rate. An appropriate intervention strategy to improve sleep quality among shift nurses are needed in public hospitals.

Keywords: Sleep quality; Shift nurse; Blood pressure; Heart rate; Thailand

INTRODUCTION

Sleep is a fundamental human need identified with both circadian rhythms and homeostatic instruments of the body [1]. Its deprivation has been shown to negatively impact on one' performance, and result in errors and accidents [2]. With a shortage in the supply of nurses and the increasing nursing care demand, hospitals allow nurses to work extended shifts and extra shifts per week [3]. Additionally, working hour of nurses is not the same as others profession. An inconsistent working schedule and high workload are the major impact on sleep, well-being and working performance [4]. Professions that involve shift work without adequate hours of rest can disrupt the circadian rhythm of the sleep-wake cycle and compromise sleep quality. Several studies had been indicated that shift-nurse had insufficient sleep duration and poor sleep quality [5-7].

Despite the fact that shift working medical caretakers endeavor to adjust their life calendars to move revolutions, they then to experience the ill effects of aggravations and expanded rate of tumor,

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Table 1 Sleep quality of shift nurses by Pittsburgh Sleep Quality Index (PSQI)

PSQI components	Frequency (N=270)	Percentage
Sleep duration (hours)		
< 7	94	34.8
≥ 7	176	65.2
Sleep latency (minutes)		
<15	52	19.3
16 - 30	72	26.7
31 - 60	95	35.2
>60	51	18.9
Day dysfunction		
No	121	44.8
Less than once a week	95	35.2
Once or twice a week	54	20
Sleep efficiency (%)		
< 65	147	54.4
65 - 74	34	12.6
75 - 84	40	14.8
≥ 85	49	18.1
Use sleep medicine		
No	200	74.1
Less than once a week	70	25.9
Overall sleep quality		
Good sleep (PSQI: 0 - 10)	170	63
Poor sleep (PSQI: 11 - 21)	100	37

cardiovascular diseases, and unpredictable menstrual cycles. An insufficient sleep is a risk factor for hypertension in adults where as high blood pressure (BP) leads to half of all strokes and ischemic heart disease events [8]. The association between blood pressure (BP) and sleep quality in adults is possible to explain by sleep fragmentation and a relative lack of restorative deeper sleep, particularly slow-wave sleep (SWS), during which sympathetic nervous system activity decreases and heart rate and BP decreases [9]. Additionally, experimental studies indicate that shorter sleep results in metabolic and endocrine dysfunction may contribute to cardiovascular disease [10, 11].

To the best of our knowledge, no studies have been focusing on an effect of sleep quality on blood pressure and heart rate among Thai shift nurses. Therefore, we determined an association between sleep quality and vital signs; blood pressure, and heart rate among shift-nurses in a public hospital in Bangkok.

METHODS

Study area and study population

A cross-sectional study was conducted to investigate an association between quality of sleep and vital signs among shift nurses in a public hospital in Bangkok during February to March 2017. This study consisted of 270 male and female registered shift nurses who had experience more than 6 months.

Data collection

A self-administer questionnaire was designed. The questionnaire was composed of general demographics, working characteristics and sleep quality. Sleep quality was assessed using the validated Thai Pittsburgh Sleep Quality Index (PSQI) to assess sleep habits and quality [12, 13]. Sleep quality was calculated by 7 components of PSQI; duration of sleep, sleep disturbance, sleep latency, sleep efficiency, use of sleep medicine, daytime dysfunction and overall sleep quality. Overall sleep quality was classified into 2 levels using PSQI score. The score greater than 10 were classified as poor sleepers. Those with a score of 10 or less were classified as fairly good sleepers.

Blood pressure and heart rate were measured by professional nurses using dynamic automated oscillometric device V in a hospital. We used to be collected at the time of participants before and after the shift on duty 15-30 minutes. Prepare the body in a relaxed environment before each measurement. Take a cuff of pressure at the upper arm to the receiver in the middle of the underside. Blood

Table 2 Association between demographic characteristics, working characteristic and sleep quality of shift nurses

Characteristics	Total N = 270		Good sleep quality (PSQI ≤ 10) n=170		Poor sleep quality (PSQI > 10) n=100		p-value
	N	%	N	%	N	%	
Gender							0.32
Male	37	13.7	26	15.3	11	11.0	
Female	233	86.3	144	84.7	89	89.0	
Age (years)							0.11
20 - 30	155	57.0	103	60.6	52	52.0	
31 - 40	96	35.0	59	34.7	37	37.0	
> 40	19	7.0	8	4.7	11	11.0	
BMI (kg/m²)							0.33
<18.5	71	26.3	44	25.9	27	27.0	
18.50 – 24.90	160	59.3	116	68.2	71	71.0	
24.91 – 29.90	39	14.4	10	5.9	2	2.0	
Marital status							0.11
Single	181	67.0	108	63.5	73	73.0	
Married	89	33.0	62	36.5	27	27.0	
Alcohol consumption							0.81
No	218	80.7	138	81.2	80	80.0	
Yes	52	19.3	32	18.8	20	20.0	
Caffeine consumption							0.08
No	20	7.4	9	5.3	11	11.0	
Yes	250	92.6	161	94.7	89	89.0	
Exercises							0.15
1-2 times/week	79	29.3	45	26.5	34	34.0	
3 times or more/week	38	14.1	21	12.4	17	17.0	
No exercises	153	56.7	104	68.2	49	49.0	
Year of work	8.76 ±0.346[a]		7.5(8)[b]		8(11)[b]		0.19
Year of shift nurse	8.76 ±0.346[a]		7.5(8)[b]		8(11)[b]		0.19
Position							0.55
Special nurse	31	11.48	18	10.6	13	13.0	
Register nurse	239	88.52	152	89.4	87	87.0	
Most working shift							
Morning	1	0.4	1	0.6	0	0.0	
Afternoon	32	11.9	16	9.4	16	16.0	
Night	237	87.8	153	90.0	84	84.0	
Percent of reported shift							
Morning shift							0.70
0 – 33.33%	232	85.9	145	85.3	87	87.0	
33.34 –66.66%	38	14.1	25	14.7	13	13.0	
Afternoon shift							0.53
0 – 33.33%	121	44.8	78	45.9	21	21.0	
33.34 –66.66%	146	54.1	91	53.5	77	77.0	
66.67 – 100%	3	1.1	1	0.6	2	2.0	
Night shift							0.34
0 – 33.33%	68	25.2	47	27.7	21	21.0	
33.34 –66.66%	194	71.9	117	68.8	77	77.0	
66.67 – 100%	8	3.0	6	3.5	2	2.0	

[a] Mean ±SD; [b] Median (IQR)

pressure may be measured several times a day. It works better than a single measurement in a quiet room and measure BP in both arms If SBP difference < 10 mm Hg use non-dominant arm. If SBP difference >10 mm Hg use higher pressure arm [14, 15].

Table 3 Association between vital signs (blood pressure, heart rate) and sleep quality among shift nurses

Characteristics	Good sleep quality (PSQI ≤ 10)		Poor sleep quality (PSQI > 10)		*p*-value
	Median	IQR	Median	IQR	
Blood pressure(mmHg)					
Systolic	108	18	108	16	0.87
Diastolic	69	14	64	13	0.18
Heart rate (bpm)	81	10	80	10	0.58

Table 4 Multivariable linear regression model of sleep quality and vital sign among 270 shift nurses

Models	Systolic BP		Diastolic BP		Heart rate	
	β	*p*-value	β	*p*-value	β	*p*-value
Unadjusted						
PSQI score	0.26	0.43	-0.03	0.47	-0.03	0.15
Adjusted model[a]						
PSQI score	0.33	0.30	-0.13	0.68	-0.30	0.21

[a] All models were adjusted for age, gender, BMI, exercise, caffeine consumption and alcohol consumption

Statistical analysis

The data was analyzed by computer program SPSS version 17. Basic descriptive statistics were used to summarize the data. Demographic characteristics data were calculated by using frequency and percentage. The working characteristics data was calculated by using frequency and percentage. Range, mean ($\bar{X}$), and standard deviation (SD) were used to analyze the scores of sleep quality. Chi-square test and linear regression were used to test the association between blood pressure and heart rate.

Ethical consideration

This research protocol was approved by Faculty of Medicine Vajira Hospital, Navamindradhiraj University Ethics Committee (Approval code no. 009/60). All participants signed the consent form before involving in this study.

RESULTS

Table 1 reported the components of PSQI questionnaire to ascertain sleep quality of 270 shift nurses in current study. Total PSQI score indicated that 63% of nurses had good sleep quality (PSQI ≤10), 37% of them had poor sleep quality. However, 65.2% of them reported long sleep duration more than 7 hours. Interestingly, only 19.3% of nurses reported short sleep latency while most of them (35.2%) had sleep latency more than half an hour to one hour. Almost a half of nurses (44.8%) reported none day dysfunction. A sleep efficiency component of PSQI showed that 54.4% nurses had their sleep efficiency less than 65%. Most of nurses (74.1%) were none uses sleep medicine whereas 25.9% of them reported taking medicine less than once a week.

Majority of participated nurses were female (86.3%). Average reported age (± SD) was 30.74 (±5.71) years old. Majority of good sleep quality nurses (60.59%) had age between 20 – 30 years old which showed the same age range of age as the poor sleep quality nurses. A 69.3% of shift nurses in this study had normal body mass index (BMI). Most of them were single (66.30%). Compared marital status between fairy good sleep quality and poor sleep quality nurses, the results showed that majority of both groups were single. There were 138 (81.18%) of nurses reported non-alcohol drinker had fairy good sleep quality. Among fairy good sleep nurses, 94.71% of them reported caffeine consumption which was higher, but not significant, than poor sleep nurses (89%). However, all demographic characteristics of nurses was not achieved significant associations with sleep quality (Table 2).

An average reported years of experiences and years of work as a shift nurse were 8.76 (±0.346) years. Around 90% of them were registered nurses while 10% were special nurses. 87.8% of nurses reported their majority of the shift as a night shift during the past month. Majority of shift during the past month was significantly associated with sleep quality. Most of nurses (90%) who had good sleep quality reported their majority of shift was night shift. Similarly, 84% of poor sleep quality nurses worked mostly in the night shift. Most of nurses reported their proportion of morning shift in the first tertile (0% – 33.33%) and reported their proportion of afternoon and proportion of night shift in the

second tertile (33.34% – 66.66%), Table 2.

Table 3 presented no differences of vital sign among good sleep quality shift nurses and poor sleep quality nurses. Median systolic blood pressure and diastolic blood pressure among good and poor sleep nurses was equal (108 mmHg). Compared diastolic blood pressure, good sleep quality nurses had higher poor sleep group. A median of heart rate among those who have good sleep quality was 81 whereas median poor sleep nurse heart rate was 80 bpm. However, multivariate model found that an increased systolic blood pressure was possible to increased poor sleep quality (increased PSQI score) (β = 0.26, p-value = 0.43). But, an increased diastolic blood pressure and heart rate were decreased PSQI score which showed a better sleep quality.

Table 4 presented the associations between score of PSQI and blood pressure and heart rate. In unadjusted model, an increased PSQI score was possible to increased systolic blood pressure (β = 0.26, p-value = 0.43). After adjustment for age, gender, BMI, exercise, caffeine consumption and alcohol consumption, an increased one score of PSQI was tented to increased 0.33 mmHg of systolic blood pressure (β = 0.33, p-value = 0.30). However, statistical significant was not achieved.

DISCUSSION

The purpose of this study was to determine an association between sleep quality and blood pressure and heart rate among shift-nurses in a public hospital. The populations of this study were 270 registered shift-nurses (37 males and 233 females). In this study the majority of female shift workers 89% had global sleep quality scores ≥5 indicating poor sleep which more than those of females in Taiwan's general population 57% [6]. This studied showed the maximum of systolic blood pressure was 135 mmHg and minimum of systolic blood pressure was 90 mmHg. An average systolic blood pressure (SBP) was 107.70 (±10.49) mmHg. The maximum and minimum diastolic blood pressure were 91 and 43 orderly with an average diastolic blood pressure (DBP) of 67.74 (±10.25) mmHg. Compared to normal blood pressure, our study participant's average systolic and diastolic blood pressure were classified in normal range; SBP equals 120 and DBP equals 80. However, some nurses in this study had pre- hypertension; SBP equals 120-139 and diastolic DBP 80-89 mmHg. We found that our shift nurses had lower average SBP

and DBP than shift nurses in a hospital in Jakarta (SBP 110.7 mmHg and DBP 74.3 mmHg) [16]. An average heart rate of shift nurses was 81.96 (±7.51) bpm. Association between sleep quality and vital sign among shift nurse. In our study, we found that general characteristics of shift nurses were not associated with sleep quality. In our study, we found that general characteristics of shift nurses were not associated with sleep quality. Similarly, previous study [17] presented no association between general characteristic of nurses and sleep quality. However, the report of most shift during the past month was associated with sleep quality (p<0.05). Most of nurses (more than 80%) reported their majority of shift as a night shift. Ohina, et al. [18] suggested that shift characteristic of nurses was associated with sleep quality (PSQI) among female nurses in Japan. The results of this study reported that there was no association between heart rate, blood pressure and sleep quality among shift nurses even if poor sleep quality was increased, it's possible to decrease heart rate and increased systolic blood pressure (p>0.05).

In multivariate model, our study found that there was no association between sleep quality blood pressure and heart rate among shift nurse though results suggested that an increased systolic blood pressure and decreased heart rate was possible to increase poor sleep quality (p>0.05). Many studies found no association between sleep quality and blood pressure. A study of Rong, et al., [19] in Chinese elderly found no significant differences in sleep quality scores, sleep latency, and sleep efficiency percentage and prevalence of poor sleep quality between subjects with and without hypertension. Additionally, there was none of the differences in systolic blood pressure and diastolic blood pressure between fairly and poor sleep quality. In contrast, Javaheri, et al., [20] found the odds of prehypertension increased 4.5-fold (95% CI, 2.1 to 9.7) in adolescents with low sleep efficiency and 2.8-fold (95% CI, 1.1 to 7.3) in those with short. The correlation between blood pressure and sleep quality could be explained that bad sleeping habits of shift workers could hurt body's ability to regulate stress hormones, leading to high blood pressure and developed to hypertension.

Several limitations of this study could be noted. First, the sleep assessment was collected once from shift nurse in a hospital which may not reflect the sleep conditions of nurses in the other hospitals. Second, the measurements of heart rate and blood pressure were done on a single day which could not

be drawn a conclusion for nurses.

CONCLUSION

Our study found that sleep quality was not associated with systolic blood pressure, diastolic blood pressure, and heart rate among shift nurses. Around 40 percent of shift nurses had reported poor sleep quality with PSQI score more than 10. Therefore, an appropriate intervention strategy to improve sleep quality among shift nurses is needed to be consider in public hospitals.

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