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Quality of Sleep Among Shift Work Nurses at the Baguio General Hospital: A Pilot Cross - Sectional Study

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ABSTRACT

Objective: The primary objective of this study was to determine the quality of sleep among 12-hour shift-work nurses at the Baguio General Hospital using the Pittsburg Sleep Quality Index (PSQI).

Methods: This was a preliminary cross-sectional study with a primary endpoint of assessing the sleep quality of the participants using the PSQI. The association of sleep quality with individual and work factors was also determined.

Design: Cross - Sectional Study
Setting: Tertiary Government Training Hospital
Patient: 154 12-hour shiftwork nurses

Results: The majority (88.96%) of the participants self-reported having poor sleep quality. Among the components of the PSQI, current shift was significantly associated with habitual sleep efficiency (Fisher exact test $p < .049$). No significant associations were found between demographic characteristics and PSQI Global score, with most respondents having poor sleep quality regardless of participant characteristics.

Conclusion: Majority of nurses working in 12-hour shifts had poor sleep quality. Night shift nurses had higher habitual sleep efficiency scores compared to day shift nurses indicating that those working in the night shift had poorer habitual sleep efficiency.

Keywords: *sleep quality; shift worker; PSQI; nurse; night shift; day shift; workplace health; 12-hour shift*

Shiftwork means employment outside the established workday, which is typically 8 am - 4 pm.[1] Essential for the successful functioning of institutions requiring 24-hour operation (such as hospitals), it requires employees to work outside of physiologic sleep hours. A shift worker is defined as a person who does not work a standard daytime schedule.[2] Shift work affects sleep quality: current or past performance of shift work was significantly associated with poor sleep quality among shift-working nurses in Shanghai, China;[3] 18% of shiftwork nurses at the Lung Center of the Philippines had Shift Work Disorder (SWD);[4] and SWD had a prevalence of 32.1% among night workers and 10.1% in day workers in a random population study.[5] Poor quality of sleep also negatively impacts ability to work which is crucial in healthcare settings.[3]

The Baguio General Hospital and Medical Center (BGHMC) currently employs 380 nurses. Among these, 308 are shift workers who work twelve-hour shifts daily. At the moment, there is

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no fixed policy dictating shift changes every seven days. These changes are dependent only on the preferences of the nurses in each unit, without regard to how it may affect quality of sleep.

The aim of this study was to determine the quality of sleep among 12-hour shift-work nurses in this institution using the Pittsburgh Sleep Quality Index (PSQI).

METHODS

This cross sectional study sought to determine the quality of sleep among consenting 12-hour shiftwork nurses using the Pittsburgh Sleep Quality Index (PSQI) from November 1 to 30, 2020. The PSQI is a widely used self-rated questionnaire to assess sleep quality. Having a diagnostic sensitivity of 89.6% and a specificity of 86.5%,[6] it showed strong reliability and validity with moderate structural validity in a variety of samples, suggesting that it fulfills its intended use to screen for sleep dysfunction.[7]

The protocol for this study was approved by Baguio General Hospital and Medical Center Research Ethics Committee (BGHMC-ERC-2020-36). Considered for inclusion were staff nurses employed at the BGHMC who were directly involved in patient care and who followed shift schedules: seven days of 7am-7pm followed by 7 days of 7pm-7am after a seven-day-off; seven days of 7pm-7am followed by 7 days of 7am-7pm after a seven-day-off. Nurses who were not directly involved in patient care, who were in the ancillary services, on duty during office hours only or head nurses assigned to administrative roles, were excluded. Additionally, staff nurses directly involved in patient care who were promoted to administrative roles, or transferred to ancillary services during the study period, or those who converted from shift schedules to office-hour schedules during the study period were excluded. Similarly, nurses undergoing psychiatric or psychological care or who were diagnosed with or treated for serious medical conditions (such as severe COVID-19) during the study period were excluded.

We used the OpenEpi version 3.01 formula of sample size

$n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$ where:

Population size (for finite population correction factor or fpc) (*N*): 352

Hypothesized % frequency of outcome factor in the population (p): 50%+/-5

Confidence limits as % of 100(absolute +/- %)(d): 5%

Design effect (for cluster surveys-DEFF): 1

Accordingly, the calculated sample size was 172. Stratified random sampling was used for the distribution of subjects into two shifts. A sampling frame was constructed based on a complete list of nurses meeting inclusion and exclusion criteria, with their respective assigned departments and shift schedules. This full list was subdivided into the two shift categories: 7am-7pm followed by 7pm-7am after a seven-day off; or 7pm-7am followed by 7am-7pm after a seven-day off. Using a random number generator, participants were chosen at random with a 20% adjustment for attrition.

Test questionnaires included the PSQI and demographic (age, sex, marital status, comorbidities) and work factor (length of employment, shift schedule) data. Selected participants were contacted through the Nursing Division Office and informed consent was obtained individually by a research assistant before participants responded to the questionnaire. Potential participants were briefed on the nature and objectives of the study, possible risks and benefits, and were informed that participation was fully voluntary, with withdrawal being possible at any point. The participants were also given the choice to skip any questions they preferred to. Test questionnaires were distributed to consenting participants, and answered at their leisure one day after completion of their shift, then retrieved seven days after distribution.

Data Analysis

Data was encoded and tabulated using the 2019 version of Microsoft Excel version (Microsoft Corp., Redmond, WA, USA) following a coding manual that was prepared prior to statistical analysis. The data was then statistically analyzed using IBM Statistical Package for the Social Sciences (IBMÒ SPSSÒ Statistics) V.17 (IBM Corp., Armonk, NY, USA) and R Project for Statistical Computing version 4.0.3 *(https://www.r-project.org/)*.

A Fisher exact test statistic was computed to explore the association of the demographic profile of the shift nurses to the participants' quality of sleep. Descriptive and inferential statistics were used in describing, comparing and analyzing data. Significance was determined as a p-value of $\leq .05$. The effects of possible confounders were also determined and controlled.

RESULTS

Out of 308 participants who consented to participate and were given test questionnaires, only 154 nurses returned the questionnaires, for a response rate of 50%. Respondents were predominantly female (67.53%) with a mean age of 32.2 years (range 23-60 years old). Less than half (42.21%) of the nurses were single. Overall, almost all nurses were part of the 12-hour shift for 8 months, wherein more than half (62.34%) were currently on day shift. Majority (89.61%) of the participants had no known comorbidities. *(Table 1)*

A majority (88.96%) of the participants self-reported having poor sleep quality with a Global PSQI score greater than or equal to 5. Based on the Fisher exact test, the association between components of PSQI (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction) and current shift (day shift and night shift), current shift was significantly associated with habitual sleep efficiency ($p < .049$). *(Table 2)*

Table 1. Distribution of Participants by Current Shift and by Pittsburgh Sleep Quality Index Components

Component	Day Shift		Night Shift		p-value
	n	%	n	%	
Subjective Sleep Quality (n=151)					*.199**
0	*10*	*6.62*	*7*	*4.64*	
1	*70*	*46.36*	*33*	*21.85*	
2	*14*	*9.27*	*15*	*9.93*	
3	*1*	*0.66*	*1*	*0.66*	
Sleep Latency (n=154)					*.652*
0	*5*	*3.25*	*3*	*1.95*	
1	*14*	*9.09*	*13*	*8.44*	
2	*37*	*24.03*	*19*	*12.34*	
3	*40*	*25.97*	*23*	*14.94*	
Sleep Duration (n=153)					*.071*
0	*7*	*4.58*	*11*	*7.19*	
1	*17*	*11.11*	*7*	*4.58*	
2	*58*	*37.91*	*28*	*18.30*	
3	*13*	*8.50*	*12*	*7.84*	
Habitual Sleep Efficiency (n=147)					*.049*
0	*43*	*29.25*	*17*	*11.56*	
1	*23*	*15.65*	*12*	*8.16*	
2	*14*	*9.52*	*9*	*6.12*	
3	*12*	*8.16*	*17*	*11.56*	
Sleep Disturbances (n=154)					*.154**
0	*3*	*1.95*	*0*	*-*	
1	*54*	*35.06*	*25*	*16.23*	
2	*37*	*24.03*	*32*	*20.78*	
3	*2*	*1.30*	*1*	*0.65*	
Use of Sleeping Medication (n=151)					*.973**
0	*81*	*53.64*	*50*	*33.11*	
1	*5*	*3.31*	*2*	*1.32*	
2	*4*	*2.65*	*2*	*1.32*	
3	*4*	*2.65*	*3*	*1.99*	
Daytime Dysfunction (n=154)					*.084**
0	*24*	*15.58*	*15*	*9.74*	
1	*56*	*37.09*	*31*	*20.13*	
2	*16*	*10.39*	*8*	*5.19*	
3	*0*	*-*	*4*	*2.60*	

*computed using Fisher exact test

Table 2. Relationship of Demographic Characteristics of 12-hour Shift Nurses and their PSQI Scores

DEMOGRAPHIC CHARACTERISTICS	PSQI Score		p-value
	0-4 Pts (n=17)	5-21 Pts (n=137)	
Age-Group (n=154)			*.726**
20-29 y/o	*6*	*50*	
30-39	*8*	*57*	
>40	*1*	*5*	
No Answer	*2*	*25*	
Sex			*.173*
Male	*8*	*42*	
Female	*9*	*95*	
Civil status			*.555*
Single	*7*	*58*	
Married	*6*	*35*	
No Answer	*4*	*44*	
Current Shift			*.831*
Day Shift	*11*	*85*	
Night Shift	*6*	*52*	
Shift Change			*.829**
Changers to Night Shift	*2*	*25*	
Changers to Day Shift	*4*	*39*	
Maintained Shift	*11*	*73*	
Length of Time Employed as an 12-hour shift worker			*NA***
0-12months	*16*	*136*	
No Answer	*1*	*1*	
Comorbidities			*.389**
With any comorbidities	*3*	*13*	
No known comorbidities	*14*	*124*	

*computed using Fisher exact test
**no test applicable as all answers were one-sided (8 months)

Mean hours of sleep for all participants were 5.69 hours, ranging from 1.5 hours to 10 hours, wherein 55.2% of the total sample reported getting 5-6 hours of actual sleep. Low scores in habitual sleep efficiency were observed to be more frequent in day shift nurses (29.25% scored 0, equivalent to >85% habitual sleep efficiency) than those among night shift nurses, of whom 11.56% had >85% habitual sleep efficiency and 11.56% had <65% sleep efficiency.

Fairly good sleep quality was reported by 46.36% of day shift nurses and 21.85% of night shift nurses. Only 5.97% of day shift nurses and 14.94% of night shift nurses had high scores in sleep latency, while 37.91% of day shift and 18.30% of night shift nurses reported a 5 to 6-hour duration of sleep. Most respondents were within the mid ranges of the sleep disturbance score and a great proportion (86.75%) reported non-use of sleeping medication in the past month. More day shift (37.09%) than night shift (20.13%) nurses had low scores for daytime dysfunction. Overall, most respondents (88.96%) had poor sleep quality, regardless of participant characteristics.

DISCUSSION

Our survey found that 88.96% of the participants self-reported having poor sleep quality (PSQI global score $\geq$ 5), with an overall mean score of 8.75 $\pm$ 3.17. Only 11.04% of the group reported having good sleep quality. Among the components of the PSQI, only habitual sleep efficiency was associated with current shift ($p < .049$), with lower scores observed among day shift nurses than night shift nurses.

In comparison to a study among nurses working in acute hospitals in South Korea, the results of the present study show a higher prevalence of poor sleep quality (79.8%), and a higher mean PSQI global score (6.52 $\pm$ 4.23).[8] These findings are also similar to a cross-sectional study in a tertiary hospital in Shanghai wherein PSQI scoring was found to be significantly associated to sleep efficiency, sleep quality and daily dysfunction.[9] However, in the current study, sleep quality and daily dysfunction were not statistically significant.

While the present study was able to determine that the majority of shiftwork nurses in the BGHMC had poor sleep quality, it was not able to identify which individual characteristic of nurses nor which work factor was associated with poor sleep quality. Additionally, only a total of 154 respondents were included and due to limitations in time and resources, the minimum sample size requirement was not fulfilled. Almost all reported to have been in 12-hour shifts for eight months. This corresponds to the hospital mandate of having staff nurses go into 12-hour shifts from the previous eight-hour-shifts to allow for a quarantine period in between shift changes. Prior to the COVID-19 pandemic, nurses were assigned one of the following shifts: 7 am-3 pm, 3 pm -11 pm and 11 pm-7 am. The assigned shift for 15 days was followed by another 15 days in another shift, depending on their arrangement with their immediate supervisor. The change in schedule was due to the emergence of the COVID-19 virus and need to provide a dedicated area of the hospital for infected patients.

While the PSQI was originally intended for psychiatric patients[6] and although there are other tools available to assess sleep, only the PSQI was used in this study. The PSQI was the most appropriate tool for this population during the peak of the pandemic as it is a self-reported, easy to administer and requires a brief time for completion. The PSQI was intended to identify the good sleepers and the bad sleepers, which this study was able to achieve.

Despite its limitations, the current study concurs with what other studies have concluded, that shift work is associated with sleep quality. Early screening of sleep quality should be done among shift workers. Programs to improve sleep quality should be designed and implemented among the nurses employed in the institution. Improvement of sleep quality has the ultimate intention of positively impacting work judgement and performance, resulting in less errors and accidents. Although other studies have shown that the other components of the PSQI were associated with shift work, these were not shown in the present study. This may be attributable to the suboptimal sample size. Future studies with larger sample sizes may reveal such relationships.

This study was limited by the COVID-19 pandemic. The change in shifts and ward assignments of the nurses, as well as quarantine protocols made it more difficult for them to participate in the research. The pandemic also increased stress levels of all hospital workers in our institution which could have contributed to the poor sleep of nurses. This study was only done on nurses working in 12-hour shifts, as the schedule of nurses were adjusted from the usual three shifts in 24 hours to two shifts to accommodate the needs of the hospital during the pandemic. In the future, this study may also be done on shift workers working in three shifts to assess if shorter shifts, or rotating in between three shifts provide better sleep quality for shift-workers. Also, this study was conducted in a single institution in the northern Philippines, thus, the results may not be generalizable to other institutions. Other tools to assess sleep quality and work quality may be used in future to look for associations between these.

In conclusion, this current study found that the majority of the nurses at the BGHMC report low sleep quality. Given that shift work remains indispensable, this finding is worthy of further consideration in order to identify ways of addressing it. A future direction of this study is assess sleep quality in other departments and with other workers in the hospital such as resident physicians who go on 24-hour duty, paramedical staff such as radiology technicians, and medical technologists. Further studies should be conducted to identify the drivers of sleep quality, as well to identify comprehensive strategies to improve them among shift workers.

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