The Impact of Sleep Quality on the Quality of Nursing Care Provided by Shift Working Nurses: A Descriptive Cross-Sectional Study in Sri Lanka

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ABSTRACT

The requirement for nurses to work in shifts is a critical issue for their health and well-being. Working in shifts disturbs sleeping patterns and degrades sleep quality. This may affect the performance of nurses as well as has adverse effects on health. There is a paucity of information on this topic in the context of Sri Lanka. Using a descriptive cross-sectional study, it was aimed to assess the relationship between quality of sleep and nursing care among nurses in two selected government hospitals. The Pittsburg Sleep Quality Index was used to assess sleep quality while nursing care was assessed by three visual analog scales, and fully completed 279 questionnaires were analyzed. A statistically significant association was identified between shift type worked by duration and minor and moderate nursing errors. However, the self-reported error rates were mostly at low rates or unreported. Comprehensively, sleep quality was not associated with the error rates perceived in this study. Results would have been more effective if circadian rhythms and different

shifting strategies were assessed. Evaluating self-reported errors limited the study comparatively. There was no overall association between sleep quality and the errors perceived. Current policies, staffing plans, and mechanisms to assist nurses in coping should be updated and implemented in a timely manner in nursing practice.

1. INTRODUCTION

Sleep is a natural, repeating mental and physical condition that is essential to every living being (American Psychiatric Association, 2022). It is characterized by altered consciousness, inhibited voluntary muscles, somewhat inhibited sensibility, and diminished interaction with the environment (American Academy of Sleep Medicine, 2008). Sleep is mainly categorized into two types; rapid Eye Movement (REM) sleep and non-REM sleep, and specific brain waves and neuronal activities are linked with each type. Sleep quality has been considered in addition to the quantity of time an individual sleeps (Weaver et al, 2016). It is recommended that young and middle-aged adults receive 7-9 hours, and older adults 7-8 hours of sleep (National Institute of Neurological Disorders and Stroke, Brain Basics, 2020). Key important factors of evaluating sleep quality were later defined as simply not evaluating the quantity or the hours of sleep but also some other as well (Hirshkowitz et al., 2015).

Increasingly, research is being undertaken regarding sleep quality and how it affects the physical and psychological well-being of healthcare workers working in different shifts (Akerstedt, 2003). There are several instruments used for assessing sleep quality among nurses, for example, the Epworth Sleepiness Scale (Kaliyaperumal et al., 2017), and the Pittsburgh Sleep Quality Index (PSQI) (Weaver et al., 2016) are a few of the utilized and reported scales.

Nurses work in shifts that have been allocated to them in daily or routine rosters, result in their different sleep patterns (Akerstedt, 2003; Ball et al., 2017) Sleep disturbances due to shift work cause fatigue, cognitive performance, sleep loss, and the inability to recover between shifts (Scott et al., 2014). Working on night shifts and rotational shifts has also an eminent effect on poorer sleep quality (Gómez-García et al., 2016) and poorer organizational and environmental performance (Ferri et al., 2016). Researchers have suggested that frequent night shift work induces sleep disorders that are currently being underestimated and it is a potential risk factor for physical and mental health, as well as a risk for accidents (Gómez-García et al., 2016).

Nursing productivity and errors in care are at more risk with the prevalence of poor sleep quality regardless of the strategies put forward in dealing with the latter (Weaver et al., 2016; Park et al., 2018; Neville et al., 2017). Furthermore, long working hours or irregular shift work causes reduced performance (Zhang et al., 2016) and contributes to delayed, missed, or inappropriate nursing care (Wolf et al., 2017). Due to the paucity of data in the Sri Lankan context, we aimed to identify, the effects of shift work on their quality of sleep and the care they provide from the perspectives of Sri Lankan nurses.

2. MATERIALS AND METHODS

A quantitative descriptive cross-sectional study.

2.1. Sample and Study Setting

Two government hospitals in the Western Province of Sri Lanka were selected as the study settings, and the population was the total staff nurse population in the two hospitals. Sample size calculation was done using the formula by Lwanga (Lachenbruch et al., 1991), in which prevalence was taken as 50% due to the unavailability of the local data, the

required sample size was 422, with the inclusion of an extra 10% to make up for any incomplete data. A convenience sampling technique was used. Inclusion criteria were being a registered nurse (RN), working in in-patient departments (medical, surgical, gynecology, obstetrics, pediatrics), and possessing more than 1 year of nursing. Nurses with less than 1 year of experience and working in outpatient departments were excluded from the study.

2.2. Data Collection

The study instrument was adapted from a study in Sweden, and changes were made in accordance with the setup where the study was being conducted (Weaver et al., 2016). There were three sections: (1)The sociodemographic section developed by the researchers included information on gender, age, marital status, experience as an RN, current and initial qualifications in nursing, and the details regarding the shift work they were involved in. (2)The Standardized Pittsburgh Sleep Quality Index (PSQI) is an instrument developed to assess the sleep quality and sleep disturbances which occur within 1 month (Buysse et al., 1989). According to the current study, the tool showed acceptable validity and reliability. (3) Three Visual Analogue Scales (VAS) were used to assess the errors perceived by RNs for each minor, moderate, and severe medical error with a categorized list that was adapted and adjusted according to the Sri Lankan context (Weaver et al., 2016).

2.3. Data Analysis

Sample data and characteristics were analyzed by SPSS (Statistical Package for Social Sciences) 25.0 version. Descriptive statistics, Chi-square test, correlation analysis, and one-way analysis of variances (ANOVA) were used for data analysis.

2.4. Ethical considerations

Ethical approval was obtained from the ethics review committee of the Faculty of Medical Sciences, University of Sri Jayewardenepura, Colombo, (Application number: Nur/ 13/19) as well as permission from the relevant hospital administrators. Informed written consent was obtained from all participants.

3. RESULTS

A total of 279 questionnaires were identified to be included in the analysis with a response rate of 78.12%. The majority of participants were female (95%), the highest number was less than 30 years (45.90%), and most participants had a working experience of 1-5 years (62.40%). An average number of shifts worked per week was reported as eight a maximum of 14 shifts and a minimum of 4 shifts with a SD of 2. Out of all the participants, 91.4% stated that they could rest during night shifts, whilst 8.6% were not allowed to rest.

Seven components (Table 1) of the Pittsburgh Sleep Quality Index (PSQI) were assessed to determine the Global PSQI score which had a mean value of 5.07, a maximum of 16, and a minimum of 0. The overall result from this section was to be found that 39.1% of the participants had healthy sleep quality while the other 60.9% of participants had poor sleep quality.

Table 1. Nurses' mean scores obtained from PSQI components	
PSQI components	Mean±SD (0-3 points)
Subjective sleep quality	0.92±0.65
Sleep latency	0.81±0.80
Sleep duration	1.07±0.85
Sleep efficiency	0.15±0.53
Sleep disturbance	1.00±0.63
Use of sleep medicine	0.18±0.48
Daytime dysfunction	0.94±0.82

There was a significant relationship between the experience as an RN and sleep quality (p = 0.02). A significant correlation between total shifts for an average week and the Global PSQI score was observed (p = 0.019) as shown in Table 2.

Table 2. Associations with different variables and Sleep quality by PSQI

Variables		Sleep Quality		
		Healthy Sleep Quality (n)	Poor Sleep Quality (n)	p-value
Age groups	<30 years	51	77	0.52
	30 - 40 Years	43	75	
	41 - 50 years	11	16	
	>50 years	4	2	
Marital status	Unmarried	45	64	0.54
	Married	64	106	
If married, children?	No	60	107	0.18
	Yes	49	63	
Experience as a RN	1 - 5 years	68	106	0.02
	6 - 10 years	11	30	
	11 - 15 years	17	23	
	16 - 20 years	5	10	
	>20 years	8	1	
Current nursing qualification	Diploma	83	124	0.83
	BSc.N	25	44	
	MSc.N	1	2	
Average 7am - 1pm shifts per week	0	1	2	0.16
	1 - 2 shifts	33	33	
	3 - 4 shifts	61	102	
	5 or >5 shifts	14	33	
Average 1pm - 7pm shifts per week	0	0	2	0.36
	1 - 2 shifts	29	35	
	3 - 4 shifts	67	112	
	5 or >5 shifts	13	21	
Average 7pm - 7am shifts per week	0	1	5	0.30
	1 shift	37	43	
	2 shifts	62	104	
	>2 shifts	9	18	
Resting time is allowed in a night shift?	No	10	14	0.79
	Yes	99	156	
Work variable shifts	No	1	7	0.1
	Yes	108	163	
Nurse : Patient in a latest night shift	0	3	7	0.167
	1:1 - 1:5	33	45	
	1:6 - 1:10	32	46	
	1:11 - 1:15	27	31	
	>1:15	14	41	

PSQI: Pittsburgh Sleep Quality Index Healthy Sleep Quality: PSQI Score <5, Poor Sleep Quality: PSQI Score >_5

The results showed that the participants who worked less than 8 hours shift perceived less minor medical errors than the participants who worked 12-hour shifts (p = <0.01) and the participants who worked more 12 hours shift (p = 0.02) in a Post Hoc test (Table 3). Similar results were gained when the Post Hoc was performed between moderate medical errors and shift groups. Participants who worked two consecutive shifts had perceived more minor medical errors than the participants who worked one consecutive shift (p = <0.01) and participants who worked more than five consecutive shifts (p = 0.017). Somewhat similar results were reported in moderate medical errors. Severe medical errors were not reported of any significance to both variables discussed above. There was a significance in the sleep quality by PSQI and perceived Moderate Medical errors (p = 0.03).

Table 3. Association with types of medical errors with different variables

Variables	Types of Medical Errors		
	Minor	Moderate	Severe
	F (p-value)	F (p-value)	F (p-value)
Habitual sleep efficiency	ANOVA 5.52(0.00) Welch 2.08(0.17)	ANOVA 7.16(0.00) Welch 2.93(0.09)	ANOVA 3.83(0.00) Welch (no value)
Hours slept	-0.435	-0.244	0.466
Types of shifts by duration	ANOVA 9.49(<0.01)	ANOVA 11.33(<0.01)	ANOVA 2.28(0.08)
Consecutive shifts worked	ANOVA 5.37(<0.01)	ANOVA 4.41(<0.01)	ANOVA 0.73(0.60)

Sleep quality by PSQI			
Healthy sleep quality	0.16	**0.03**	0.19
Poor sleep quality	0.16	**0.03**	0.19
PSQI: Pittsburgh Sleep Quality Index, ANOVA: Analysis of variance			

4. DISCUSSION

Among the 279 participants, 60.9% reported poor sleep quality, similar to those in a study conducted in Istanbul, where the percentage of the participants who had poor sleep quality was 61.9% (Tarhan et al, 2018). Perceived average sleep quality using the PSQI was 7.07 among ICU nurses in a hospital setting in China, and 62.9% of the participants showed poor sleep quality (Tsai et al, 2019). In a study that addresses the sleep quality among female hospital nurses, the percentage among the study participants was 75.0% (Chien et al, 2013). In comparison, there was a progression of variances in poor quality of sleep among the nursing personnel worldwide. This may be related to the staffing, the patient capacity, and the organizational policies and procedures that affect nurses' quality of sleep in addition to the sociodemographic characteristics. Compared to other studies, the scores obtained in this study were relatively lower and suggested a lack of sleep or poor sleep quality (Tarhan et al, 2018; Chien et al, 2013). The global PSQI mean score and SD for the study was 5±3, which had a minimum score of 5 and a maximum score of 16. Moreover, there was a collective value of sleep quality in day and night shift nurses. All day and night shift nurses showed poor sleep quality using the PSQI among Swedish Nurses (Weaver et al, 2016).

In the current study, high scores were only achieved in sleep duration, subjective sleep quality, and daytime dysfunction, which was similar to a study reviewed (Tarhan et al, 2018). In the current study, the mean score obtained for sleep duration in rotating shift working participants was relatively higher than in a previous study but was in the minimal range that could be scored for the component (Gómez-Garcíaet al., 2016). Rotating shift working nurses may perceive that shift patterns induce further irregular sleep-wake times (Chung et al.). There was a significance between age groups (p = 0.00), duration of professional experience (p = 0.001), the type of shift worked (p = 0.00), and as well as smoking status (p = 0.01) with sleep quality which was assessed in the study by Chien et al (2013). This study reported significance only with the level of experience. Longer shifts with night shifts, and quick returns to work with inadequate recovery time between shifts were associated with poorer sleep (Querstret et al., 2020).

Napping can be beneficial in addressing the aspects of the duration and the timing of the naps during shift work if implemented, as suggested in a systematic review conducted in the UK (Querstret et al., 2020). A review on napping in night shifts suggested that nursing or the organizational management is responsible for implementing ways to establish policies, programs, practices, and systems at work that promote health and reduce adverse effects of shift work on nurses, though there was no significance to be found between resting hours within shifts and sleep quality (Li et al, 2019).

Shift work seriously affects the circadian rhythms of workers (Costa, 2010), hence it is necessary to assess the circadian rhythm in each type of shift in the rotational shift type (Donaldson et al., 2021). Results obtained suggest that rotating shifts may be preferable in terms of cardiac autonomic regulation (Li et al., 2019). The present study found no significance in working in variable shifts, and the quality of sleep as determined by the PSQI. Lower hours asleep/ hours in bed were associated with higher self-perceived minor errors (p = 0.02) among Swedish critical care nurses (Weaver et al.,

2016), however, in our study no significance was reported between Habitual Sleep Efficiency (HSE) and the types of medical errors perceived. Self-reported quality of care was higher amongst nurses who worked ≤8-hour shifts (15.9%) compared to those who worked longer hours (20.0 to 21.1%) in a sample of English hospitals (Ball et al., 2017). Among the nurses in a study in Japan, the three-shift rotation was influential in poor sleep quality (Uekata et al., 2019).

In this study, a significant association between minor and moderate medical errors perceived and the type of shift by duration was reported. There was a significant relationship between perceived moderate medical errors in the sleep quality on the PSQI, which was an interesting revelation ($p = 0.03$). This was unexpected as there was no significance between minor medical errors perceived with sleep quality by PSQI. However, there were no statistically significant relationships with either of the categories of medical errors perceived with sleep quality by PSQI in a study conducted among Swedish critical care nurses (Weaver et al, 2016). Therefore, It was assumed that it can be ruled out that the errors listed under moderate medical errors were more prone to occur in the government hospital setting, and the errors were related to most of the procedures carried out routinely. In contrast, minor medical errors occurred much less or maybe not self-reported or not considered. Self-reported error rates or quality of care may be lower than that of errors obtained under direct observation. It may be possible that the errors were made, and harm occurred but was unreported (Scott et al, 2014). Therefore, the insignificance among minor medical errors perceived and sleep quality by PSQI can be explained versus the significance found in the Swedish study (Weaver et al, 2016).

5. CONCLUSIONS AND LIMITATIONS

Many of the study participants showed poor sleep quality by PSQI. However, there was a significance with sleep quality by PSQI and moderate medical errors perceived. Higher rates of errors were perceived in longer shifts but sleep duration in the sample was not associated with the errors perceived. Comprehensively, the sleep quality was not associated with the error rates as perceived in this study.

In this study, assessing the circadian rhythms of the nurses, distance to the hospital, number of kids, traveling time, and mode of transportation were not considered and these may also limit the findings to some extent. Hence, better results might have been expected if the study was undertaken among nurses who worked separate night and day shifts, and not rotating shifts.

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