Sleep disorder among shift work nurses and its impact on their quality of life at Al Ahrar Governmental Hospital, Zagazig City, Egypt

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Background
Shift work sleep disorder is a crucial occupational health problem for nurses that not only causes health problems for them but also affects patient's safety and job performance.

Objective
The aim was to assess the magnitude of sleep disorders among shift working nurses at Al Ahrar Governmental Hospital and to determine the associations between sleep disorders and work characteristics and their impact on quality of life.

Materials and methods
A comparative cross-sectional study was conducted among 180 nurses. Data collection was done by using Pittsburgh Sleep Quality Index to measure the quality of sleep, insomnia severity index to measure self-perception of insomnia symptoms, Epworth sleepiness scale to measure daytime sleepiness symptoms, and functional outcome of sleep questionnaire to measure the quality of life.

Results
It has been estimated that 73% of shift work nurses are suffering from poor subjective sleep quality compared with the morning shift group (20%) and 60% of shift work nurses had sleep disturbances compared with 36.7% among the morning shift group with a significant difference (<0.01). Of the shift work group 31.1% was suffering from daytime sleepiness and 11.1% of them was suffering from moderate severity insomnia compared with 8.9% of the day working group ($P<0.001$). The overall average score of functional outcomes of sleep quality was higher among the day working group (17.62±1.07) compared with (16.23±1.4) of the shift work group ($P<0.001$).

Conclusion
Shift work sleep disorders are prevalent and important health concerns among nurses. Nurses' sleep disorders can affect the patient's safety by affecting the nurse's performance and care quality. Therefore, planning for improving work shift schedules by hospital administration can be helpful and the use of day rest after night shift work can improve the sleep quality of nurses.

Keywords:
nurses, sleep disorders, sleep quality, work shifts

Introduction

Shift work is defined as a diversity of working hour's arrangements, including night shifts, overtime work, and irregular or rotational work patterns (Nazatul *et al.*, 2008). Also, described as 'a way of organizing daily working hours in which different persons or teams work in succession to cover more than the usual 8-hour workday, up to and including the whole 24 h' (Costa, 2003).

Circadian rhythm is the 24 h rhythmic output of the human biological clock (Drake *et al.*, 2004). Circadian rhythms regulate the individual's behavior, physiology, and cognitive function (Huth *et al.*, 2013). American Academy of Sleep Medicine defined shift work sleep disorder (SWSD) as a sleep disorder affecting individuals who frequently rotate shifts and work at night. This pattern of work goes against the natural circadian rhythm of the body, and the individual has difficulty in adjusting sleep and wake schedule. SWSD consists of constant or recurrent pattern of sleep interruption that may result in insomnia or excessive daytime sleepiness (Drake *et al.*, 2004).

Shift work schedules could be associated with increased risk of accidents and injuries (Barger *et al.*, 2006) and may aggravate fatigue which leads to the human error

part of medical errors (Czeisler *et al.*, 2005). Sleep disturbance is one of the most common health-related effects of shift work particularly among health-care workers (Garde *et al.*, 2011).

Nurses are prone especially to sleep disturbance as they are exposed to many situations which may have a negative effect on sleep quality, including work schedule (Nazatul *et al.*, 2008).

Some studies have shown that up to 57% of female shift working nurses had sleep disturbance (Ghalichi *et al.*, 2013). Dorrian *et al.* (2011) indicated that 'sleep problems, high levels of stress, exhaustion and low job satisfaction are prevalent among nurses and midwives'.

Sleep disorders negatively influence the individual's health, causing fatigue, tension, and gastrointestinal disorders. They also negatively affect the socioeconomic status through decline of productivity and also decreased concentration ability (Rajaratnam *et al.*, 2011). A study among nurses in Malaysia showed that the prevalence of sleep disturbance among shift working nurses was 62.0% more than that of non-shift working nurses (21.5%) (Nazatul *et al.*, 2008).

This was consistent with the results of a study among nurses in Thailand which showed that there was a high prevalence (73%) of poor sleep quality and the prevalence was more widespread among nurses working in shifts (76.7%) than non-shift nurses (Tawanchai, 1997). And the prevalence of insomnia among shift working nurses (29.2%) was three to four times higher than that in the general population in a study conducted in Japan (Kageyama *et al.*, 2001).

Objectives

The objectives of the study were the following:

(1) To assess the magnitude of sleep disorders among shift working nurses at Al Ahrar Governmental Hospital.
(2) To determine the associations between sleeping disorders and work characteristics and their impact on quality of life.

Materials and methods

Study design

A comparative cross-sectional study.

Place and date of study

The study was conducted among nurses at Al Ahrar Governmental Hospital during 2018.

Study sample

The target population was shift work nurses working at Al Ahrar Governmental Hospital and a comparable group of non-shift working nurses. According to the statistical records of Al Ahrar Governmental Hospital, the total number of nurses in 2017 was 675 nurses; they were divided into 558 shift work nurses and 117 non-shift work nurses. By assuming that the percentage of SWSD among shift working nurses (32.1%) and among non-shift working nurses (13.5%) (Zhou *et al.*, 2017) at a confidence interval of 95%, with a study power is used when we calculate the sample size when we use open epi or epi info (they are statistics programs).

Inclusion criteria

The inclusion criteria were currently working nurses, both men and women, all ages and qualifications, full time, permanent and have worked for a duration not less than a year.

Tools

All participant nurses were subjected to the following:

(1) Individual and work characteristics: including age, educational level, marital status, duration of work, and use of sedatives or stimulant medications.
(2) Insomnia severity index (ISI): to measure self-perception of insomnia symptoms and the degree of distress caused by insomnia. Scoring is based on a 0–4 scale for the seven Likert response items and the total score range from 0 to 28 (Savard *et al.*, 2005).

ISI scoring system	
Degree of insomnia	Range of score
No clinical significant insomnia	0–7
Subthreshold insomnia	8–14
Clinical insomnia (moderate severity)	15–21
Clinical insomnia (severe)	22–28

(1) Epworth sleepiness scale (ESS): to measure daytime sleepiness symptoms, the questionnaire consisted of eight items and has a four-point Likert response format (0–3), with a total score range from 0 to 24, the higher scores indicating the greater daytime sleepiness. Scores greater than or equal to 11 are considered to be abnormal and positive for daytime sleepiness (Johns and Hocking, 1997)
(2) Pittsburgh sleep quality index (PSQI): to determine sleep disorders by measuring the seven items which are:
　(a) subjective sleep quality.

(b) sleep latency.
(c) sleep duration.
(d) habitual sleep efficiency.
(e) sleep disturbance.
(f) use of sleep medication.
(g) daytime dysfunction.

Scoring of each item ranges from 0 to 3, where 3 reflects the negative extreme on the Likert Scale, the total score of the seven items ranges from 0 to 21. A component score greater than or equal to 2 reflects a poor quality of this component, while the total score greater than 5 indicates a poor sleep quality (Garbarino, 1999).

(3) Functional outcomes of sleep questionnaire: assessing the impact of sleep disorders on the functional outcomes relevant to the daily behaviors and sleep which are related to the quality of life. The questionnaire is categorized into five subscales:
(a) Activity level.
(b) General productivity.
(c) Social outcome.
(d) Vigilance.
(e) Intimacy and sexual relationships.

The questionnaire has 30 items with a four-point Likert scale (1=extreme difficulty, 4=no difficulty), the total scores range from 5 to 20. Scoring less than or equal to 10 indicates higher difficulty, while the higher the scores the better the functional status (Weaver *et al.*, 1997).

Ethical consideration

Participation in the study was voluntary and informed consent was taken prior to data collection and ethical committee approval was obtained.

Data analysis

Data were managed and statistically analyzed by using the Statistical Package for the Social Sciences (SPSS) version 21.0, Armonk, NY: IBM Corp. Qualitative data were described in the form of frequency and percentage; χ^2 test or Fisher's exact test was used for comparison between groups, as appropriate. Quantitative data were described in the form of measures of central tendency (arithmetic mean) and measures of dispersion (standard deviation) after testing for normality by the Kolmogorov–Smirnov test. Student's *t*-test was applied for comparing two means. Pearson's correlation coefficient (r) was used for testing the association between two continuous variables. Regression analysis was used for detecting the predictor variables. Differences were considered as statistically significant when the *P* value is less than 0.05.

Table 1 demonstrates the sociodemographic and work characteristics of participants, 78.9% of participants were women and 21.6% were above 40 years. The mean age of shift work nurses was lower than that of the morning shift work group (32.11±6.14 vs 37±7.84 years) with statistically significant difference

Table 1 Sociodemographic and work characteristics of shift work and non-shift work nurses

General characteristics	Work type [n (%)]			P
	Shifts (N=90)	Morning shift (N=90)	Total (N=180)	
Sex				0.58
Females	69 (76.7)	73 (81.1)	142 (78.9)	
Males	21 (23.3)	17 (18.9)	38 (21.1)	
Age (years)				<0.001
<30	34 (37.8)	14 (15.6)	48 (26.7)	
30–40	43 (47.8)	50 (55.6)	93 (51.7)	
>40	13 (14.4)	26 (28.8)	39 (21.6)	
Mean±SD	32.11±6.14	37±7.84	34.55±7.45	<0.001
Residence				<0.001
Rural	46 (51.1)	17 (18.9)	63 (35)	
Urban	44 (48.9)	73 (81.1)	117 (65)	
Educational level				0.03
Diploma	65 (72.2)	30 (33.3)	95 (52.8)	
Bachelor's	25 (27.8)	60 (66.7)	85 (47.2)	
Marital status				0.4
Married	81 (90)	84 (93.3)	165 (91.7)	
Unmarried	9 (10)	6 (6.7)	15 (8.3)	
Current job duration (years)				<0.001
<10	40 (44.5)	16 (17.8)	56 (31.1)	
10-20	37 (41.1)	51 (56.7)	88 (48.9)	
>20	13 (14.4)	23 (25.5)	36 (20)	
Mean±SD	11.62±6.23	15.23±7.4	13.42±7.06	<0.001

Table 2 Mean and proportion of Pittsburgh sleep quality index score and its components among shift work and non-shift work nurses

Variables	Work type		Significant test	P value
	Shifts (n=90)	Morning shift (n=90)		
Subjective sleep quality				
Mean score±SD	2.26±0.76	1.17±0.53	$t=11.42$	<0.001
Proportion (score ≥2) [n (%)]	73 (81.1)	18 (20)	$\chi^2=67.2$	<0.001
Sleep latency				
Mean score±SD	1.57±0.58	1.35±0.64	$t=2.43$	<0.01
Proportion (score ≥2) [n %)]	50 (55.6)	32 (35.6)	$\chi^2=7.2$	<0.01
Sleep duration				
Mean score±SD	1.42±0.63	0.81±0.42	$t=7.6$	<0.001
Proportion (score ≥2) [n (%)]	37 (41.1)	7 (7.8)	$\chi^2=27.07$	<0.001
Habitual sleep efficiency				
Mean score±SD	1.02±0.58	0.71±0.52	$t=3.4$	<0.01
Proportion (score ≥2) [n (%)]	12 (13.3%)	4 (4.4%)	4.39*	0.03
Sleep disturbances				
Mean score±SD	1.65±0.83	1.33±0.61	$t=2.9$	0.04
Proportion (score ≥2) [n (%)]	54 (60%)	33 (36.7%)	$\chi^2=9.8$	<0.001
Daytime dysfunction				
Mean score±SD	0.54±0.62	0.68±0.51	$t=1.7$	0.09
Proportion (score ≥2) [n (%)]	4 (4.4)	2 (2.2)	0.62*	0.6
Use of sleeping medication				
Mean score±SD	0	0	–	–
Proportion (score ≥2) [n (%)]	0	0	–	–
PSQI global score				
Mean global score±SD	8.41±1.9	6.04±1.42	$t=9.4$	<0.001
Proportion of poor sleepers (total score >5)	79 (87.8)	51 (56.7)	$\chi^2=19.1$	<0.001

*Fisher's exact test.

Table 3 Mean and proportion of Insomnia severity index and Epworth sleepiness scale among shift work and non-shift work nurses

Variables	Work type		Significant test	P value
	Shifts (n=90)	Morning shift (n=90)		
Epworth sleepiness scale				
Mean score±SD	9.33±2.16	8.05±1.38	$t=4.7$	<0.001
Proportion (score ≥11) [n (%)]	28 (31.1%)	8 (8.9%)	$\chi^2=13.8$	<0.001
Insomnia severity index [n (%)]				
No (0–7)	1 (1.1)	17 (18.9)	19.98*	<0.001
Subthreshold (8–14)	79 (87.8)	71 (78.9)		
Moderate insomnia (15–21)	10 (11.1)	2 (2.2)		
Mean score±SD	11.64±2.3	9.67±2.17	$t=5.79$	<0.001

*Fisher's exact test.

($P<0.001$). Regarding residence, 81.1% of morning shift work group live in urban areas compared with 48.9% of the shift work group ($P<0.001$). Higher education was more prevalent among the morning shift group compared with the shift work group (66.7 vs 27.8%). Mean job duration among the morning shift group was higher compared with the shift group (15.23±7.4 vs 11.62±6.23, $P<0.001$).

Table 2 demonstrates the mean scores and proportion of Pittsburgh sleep quality index (PSQI) seven components and total score, 'A component score greater than or equal to 2, and PSQI score greater

than 5 indicate a poor score.'Of the shift group nurses, 73% suffer from poor subjective sleep quality compared with the morning shift group (20%), and the mean scores (2.26±0.76 vs 1.17±0.53) have differed significantly ($P<0.001$). Also, 60% of shift group nurses had sleep disturbances compared with 36.7% among the morning shift group with a significant difference (<0.01).

Also, significant differences were apparent for sleep duration and sleep latency, 41.1% of the shift work group was suffering from insufficient sleep duration as compared with 7.8% of the morning shift group

Table 4 Mean and SD of functional outcome of sleep quality score and its components among shift work and non-shift work nurses

Components	Type of work (mean±SD)		t-test	P
	Shifts (n=90)	Morning shift (n=90)		
General productivity	3.48±0.56	3.43±0.54	0.67	0.5
Social outcome	3.06±0.46	3.46±0.54	5.2	<0.001
Activity level	2.86±0.75	3.51±0.69	5.9	<0.001
Vigilance	3.24±0.58	3.26±0.44	0.28	0.7
Intimacy	3.56±0.49	3.48±0.5	1.04	0.2
Overall average score of FOSQ	16.23±1.4	17.62±1.07	4.18	< 0.001

FOSQ, functional outcomes of sleep questionnaire.

Table 5 Pearson's correlations between insomnia severity index, Epworth sleepiness scale, Pittsburgh sleep quality index, age, duration of work, and number of shifts among shift work nurses

	Insomnia severity index	Epworth sleepiness scale	Pittsburgh sleep quality index
Insomnia severity index	–	0.337**	0.579**
Epworth sleepiness scale	0.337**	–	0.588**
Pittsburgh sleep quality index	0.579**	588**	–
Duration of work	–0.087	–0.232*	–0.246*
Number of shifts	0.414**	0.501**	0.390**
Age	–0.094	–0.280**	–0.297**

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level (two-tailed).

with mean scores (1.42±0.63 vs 0.81±0.42) and sleep latency score (1.57±0.58 vs 1.35±0.64 with $P=0.01$). Habitual sleep efficiency mean score was 1.02±0.58 in the shift work group, as compared with a mean score of 0.71±0.52 in the morning shift work, indicating inefficient sleep ($P=0.01$). There is no statistical difference between the studied groups regarding daytime dysfunction and no one of the studied groups took sleep medication. However, there is significant differences in the mean (PSQI) total score greater than 5 were observed among 87.8% of the shift work group compared with 56.7% of the morning shift group ($P<0.001$).

Table 2 shows that 31.1% of the shift work group was suffering from daytime sleepiness which was assessed by the ESS; the mean score was higher among the shift work group 9.33±2.16 compared with 8.05±1.38 of the day working group ($P<0.001$). Of the shift work group 11.1% was suffering from moderate severity insomnia compared with 8.9% of the day working group ($P<0.001$) with mean score of ISI (9.33±2.16 vs 8.05±1.38) (Table 3).

Table 4 shows that There is no significant difference regarding general productivity, vigilance, and intimacy while the activity level mean score was higher among the day working group (3.51±0.69) compared with (2.86±0.75) that of the shift work group and the overall average score of functional outcomes of sleep quality was higher among the day working group (17.62±1.07) compared with (16.23±1.4) of the shift work group ($P<0.001$) (Table 5).

There was significant positive correlation between the number of shifts and ISI, ESS, and Pittsburgh sleep quality index ($P=0.05$), while the duration of work and age had negative correlation with both ESS and Pittsburgh sleep quality index. There was no correlation between ISI and duration of work and age, while had positive correlation with the number of shifts.

Table 6 represents the regression analysis for the predictor variables of ISI, Epworth sleepiness scale, and Pittsburgh sleep quality index. The number of shifts was the predictor variable for all of them, while younger age, less duration of work, marital status and education were predictors of Pittsburgh sleep quality index among shift work nurses.

Discussion

Sleep is an essential biological function to human health and well-being (Caruso, 2014). Shift work is associated with considerable physiological and psychological impacts such as anxiety (Oyane et al., 2013), insomnia, impaired focus, fatigue, low quality of care, and reduced job performance (Tahghighi et al., 2017).

In this study, 73% of shift group nurses suffered from poor subjective sleep quality compared with the morning shift group (20%), and the mean scores (2.26±0.76 vs 1.17±0.53) have differed significantly ($P<0.001$), which is consistent with the result of a study in China, which reported that the the poor sleep quality rate was 72.1% among shift work nurses (Zhang

Table 6 Predictors of insomnia severity index, Epworth sleepiness scale, and Pittsburgh sleep quality index among shift work nurses

	β	Significance
Pittsburgh sleep quality index		
Sex (1=female, 2=male)	0.020	0.77
Age	−0.622	0.008[*]
Number of shifts	0.228	0.007[*]
Residence (1=rural, 2=urban	0.174	0.018[*]
Marital status (1=married, 2=unmarried)	−0.085	0.25
Duration	−0.451	0.04[*]
Education (1=diploma, 2=Bachelor's)	−0.063	0.4
Epworth sleepiness scale		
Sex (1=female, 2=male)	−0.066-	0.33
Age	0.053	0.8
Number of shifts	0.467	0.001[*]
Residence (1=rural, 2=urban	0.033	0.63
Marital status (1=married, 2=unmarried)	0.027	0.71
Duration	−0.197-	0.36
Education (1=diploma, 2=bachelor's)	0.027	0.7
Insomnia severity index		
Sex (1=female, 2=male)	−0.124-	0.07
Age	0.076	0.97
Number of shifts	0.389	0.001[*]
Residence (1=rural, 2=urban	0.025	0.73
Marital status (1=married, 2=unmarried)	−0.101-	0.17
Duration	−0.096-	0.66
Education (1=diploma, 2=bachelor's)	−0.013-	0.86

et al., 2016) and in another study from Taiwan, 75.8% of shift nurses suffered from poor sleep quality (Chien et al., 2013). In addition, Han et al. (2016) investigated 2,033 nurses about sleep disorders in Harbin Medical University and observed that poor sleep quality was among 42.9% of shift nurses, which is lower than the result of this study.

None of the present studied groups reported using sleep medication. In contrast, in a study from Brazil, ~17.7% of shift work nurses used sleep medications (Rocha and Martino, 2009).

In our study, the mean total PSQI score was 8.41±1.9 among shift work nurses compared with 6.04±1.42 of morning shift nurses, which is a reflection of poor sleep quality. In a study conducted in Turkey on 418 nurses, the mean total PSQI score was 7.46±3.58, which is better than the present study (Karagozoglu and Bingol, 2008). In another Norwegian study, the average total score of PSQI was 7.5±3 among nurses working in the intensive care unit, which is lower than that of the present study (Bjorvatn et al., 2012). Furthermore, the mean total score of PSQI was 7.32±3.24 among Chinese nurses who work in shift (Dong et al., 2017).

In this study, only 4.4% of shift work nurses reported daytime dysfunction due to sleep disorders, which was

much lower than that of an Iranian study, which reported, shift working or work rotation on different weekdays, increases the prevalence of sleep disorders. As a result, nurses have a feeling of discomfort and sleepiness in their workplace, which leads to reduce the quality of service delivered to patients and increase the risk of occupational errors (Bazrafshan et al., 2018).

On the basis of the present study results of ESS, 31.1% of shift work nurses was suffering from daytime sleepiness, the mean score was higher among the shift work group (9.33±2.16) compared with (8.05 ±1.38) that of the day working group (P=0.001). The result of the present study was higher than that of the study from Norway, the rate of daytime sleepiness among nurses was 25% (Bjorvatn et al., 2012), and the study from Corpus Christi (USA), the rate of daytime sleepiness was 22% among shift work nurses (Surani et al., 2015).Our study showed that the mean score of ESS increased with increasing the number of shifts in the week indicating positive correlation. A study conducted by Zhen et al. (2006) showed that there was a significant and linear relationship between the number of shifts and disorders rate (P<0.001).

The results of the ISI showed that 11.1% of the shift work group was suffering from moderate severity

insomnia compared with 8.9% of the day working group; this result was lower than that of a study in Iran, in which 55% of shift work nurses suffered from moderate-to-high severity of insomnia that could be very dangerous to the nursing society (Bazrafshan *et al.*, 2018) and another study conducted by Yazdi *et al.* (2014) onserved thatthe prevalence of insomnia among 160 nurses was high.

This study showed that there is a linear and positive correlation between insomnia severity among nurses and the number of shifts. Similarly, it was noticed in the study by Yazdi *et al.* (2014) that the number of nurses' night shift had a significant positive effect on insomnia severity among nurses ($P<0.05$).

This study demonstrated that sex was not a predictor variable for insomnia severity, daytime sleepiness, and sleep quality. In contrast, the results of an Iranian study showed that the mean score of sleep quality in female nurses was significantly less than of male nurses, which may be due to the weaker body structure of women and her domestic responsibilities (Bazrafshan *et al.*, 2018).

In our study, shift nurses reported worse sleep quality in addition to more repercussion on daily activities. Similar findings were reported by Ferri *et al.* (2016) who found that shift nurses had greater emotional instability and worse social relationships.

Conclusion and recommendations

The results of this study, as well as studies from other countries, showed that nurses are at risk of sleep disorders. Work shift sleep disorders are prevalent and important health concerns among nurses. Nurses sleep disorders can affect patient's safety through the nurse's performance and care quality. Therefore, planning for improving work shift schedules by the hospital administration can be helpful and the use of day rest after night shift work can improve the sleep quality of nurses.

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Conflicts of interest

There are no conflicts of interest.

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