Research Paper
Associations of the Sleepiness With Physiologic Changes in Night Shift Rehabilitation Healthcare Workers

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ABSTRACT

Background: Sleepiness and the changes in vital signs affect the quality of work of hospital staff. This study aimed to investigate the relationship between sleepiness and physiological changes and vital signs in night shift workers in rehabilitation staff.

Materials and Methods: This study was a cross-sectional study performed on night shift personnel of Rafideh Hospital in Tehran City, Iran, in 2018. A questionnaire, including demographic information and the Stanford sleepiness scale, was used for data collection. The results were analyzed using repeated measures analysis in SPSS software v. 21.

Results: The Mean±SD age of the participants was 38.23±5.96 years, comprising 33 men (64.7%) and 18 women (35.3%). Most personnel were married (72.5%) and non-smoker (82.4%). The amount of sleepiness increased significantly with increasing working time. Demographic characteristics had no significant association with sleepiness. However, there was a significant negative association between sleepiness and heart rate, and oral temperature. Blood pressure showed a decreasing trend with increasing working time until midnight. Also, an increase in blood pressure was recorded at 2 AM.

Conclusion: The findings of this study showed that sleepiness might have a significant association with vital signs in night work personnel. Hence, proper planning of shift work schedules and compatibility with physiological conditions might result in better working conditions for medical staff.

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1. Introduction

Generally, any job performed regularly outside the daily work time frame is considered shift work [1]. In other words, shift work is defined as non-standard programs in which at least 50% of the work is done at a time outside 8 AM to 4 PM [2]. Research has shown that the most common complaint in people working in industrial and healthcare settings during shift work is circadian rhythm sleep disorder [3]. The most remarkable effect of shift work on the workers is sleepiness. It is a tendency to sleep and a more subjective symptom, although there are behavioral manifestations. There is usually a close relationship between sleepiness and productivity. Factors such as time of awakening, shift, and shift rotation speed play an important role in performance. Several studies show the occurrence of sleepiness among most shift workers during the night shift, while it is less likely to happen during the day work shifts [1-4]. Chronic sleepiness often occurs after the repetition of night shifts, which results in clinical complications and reduced productivity [1, 4].

One of the workgroups in shift night schedules is health care workers, and the irregular sleep pattern reduces the quality of sleep, sleep duration, and job performance [5]. Sleep disorders might cause excessive daytime sleepiness, affecting mood, alertness, memory, safety, and daily functions. It is one of the most critical issues among healthcare workers [6]. In this regard, sleepiness and floating vital signs of drowsy workers during the night shift might have reciprocal effects.

Accordingly, sleepiness reduces the quality of life and endangers the physical, mental, social, and emotional health of people. Therefore, healthy sleep is necessary for the recovery of the workers. Since sleepiness among night shift employees can negatively affect the physiology of the employee and result in reduced physical and mental performance of health care workers, this study is particularly important. It is noteworthy that in Iran, no study has been conducted to investigate the relationship between sleepiness and physiological changes and vital signs among night shift medical personnel. Therefore, this study aimed to investigate the process of sleepiness with physiological changes and vital signs in night shift rehabilitation medical staff of a hospital in Tehran.

2. Materials and Methods

The present study is a descriptive-analytical cross-sectional study that was conducted in a field-based manner.

The research population includes the night shift personnel of Rafideh Hospital in Tehran City, Iran in 2018. Since this study was conducted on the hospital night shift workers, all of them were included in the study by census method. However, out of 66 people in the night shifts, 51 people participated in the study because five did not meet the inclusion criteria, and the other 10 were excluded.

The inclusion criteria were working night shifts for at least one year and filling the informed consent. The exclusion criteria were non-cooperation of personnel at any stage of the research, having second jobs; regular use of sleeping pills or migraine pills; having cardiovascular diseases, known sleep disorders (other than sleepiness), or any active infectious disease that can affect the study results.

A two-part questionnaire was used to collect information. The first part contains demographic information that includes age, height, weight, gender, level of education, marital status, duration of employment, and smoking. The second part includes the assessment of sleepiness with the Stanford sleepiness scale, which is scored from 1 to 7. The validity and reliability of this questionnaire in the Iranian population have been reported by Zarei-fard et al. as 0.68 and 0.88, respectively [7].

A mercury thermometer was used to measure oral temperature; a digital wrist gauge was used to measure heart rate; a digital sphygmomanometer was used to measure systolic and diastolic blood pressure, and a chronometer was used to measure respiration. To collect information, the sleepiness questionnaire was completed and collected for 4 nights at 8 PM, 10 PM, midnight, and 2 AM. Blood pressure, heart rate, oral temperature, and respiration rate per minute were also measured simultaneously. After collecting the data, a code was given to each questionnaire to prevent errors in counting. SPSS software v. 21 was used for data analysis.

In the descriptive analysis, demographic information, including the frequency and percentage of variables of gender, age, work experience, marital status, and smoking status, were reported. As the parameters of the variables studied in this research were measured over time, we used repeated measures analyses.

3. Results

In the present study, out of 51 participants, 18 (35.3%) were women, and 33 (64.7%) were men. The Mean±SD age of staff was 38.23±5.96 years. The youngest and oldest were 29 and 48 years old, respectively. Regarding education level, 19 participants (37.3%) had a Master's

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Table 1. The relationship between sleepness changes and demographic characteristics

Variable	F Statistics[*]	P
Time (Sleepiness)	235.13	0.0001
Gender	0.112	0.888
Marital Status	0.619	0.536
Education Level	0.655	0.724
Smoking	1.795	0.174
Age	0.546	0.576
Work Experience	0.128	0.874
BMI	0.363	0.690

[*]Based on the Greenhouse-Geiser test result

degree, and the lowest frequency was related to a PhD degree, with 6 participants (11.8%). Others had education levels lower than Master's. The Mean±SD work experience of personnel in this study was 10.27±5.10 years. The least experienced and most experienced participants had 3 and 18 years of work experience, respectively. Regarding marital status, 14 (27.5%) were single, and 37 (72.5%) were married. Regarding the staff smoking status, 42 (82.4%) were non-smokers, and 9 (17.3%) were smokers. The Mean±SD body mass index of the personnel was 24.5±3.54 kg/m2. Also, the lowest and highest body mass index were 18.62 and 30.39 kg/m^2, respectively.

The trend of sleepiness among the night shift staff of Rafideh Hospital is shown in Figure 1. Sleepiness was increasing over time. In other words, the increase in sleepiness among employees has been statistically significant (P<0.001).
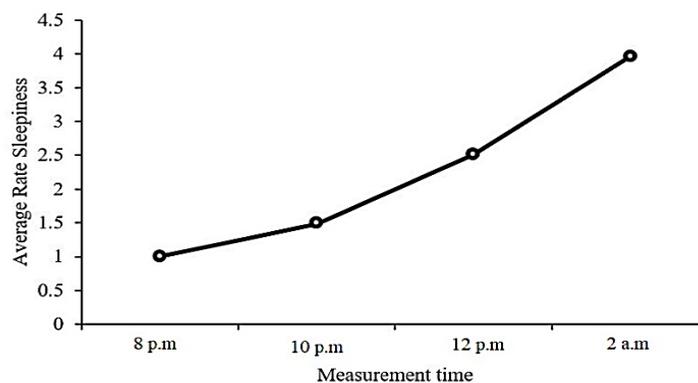
The relationship between the changes in sleepiness and heart rate is shown in Figure 2. The results indicate that the association between changes in sleepiness and heart rate over time is significantly negative (P<0.001).

Figure 3 shows the relationship between the changes in sleepiness and oral temperature among hospital staff. According to the results, the association between changes in sleepiness and oral temperature over time is significantly negative (P<0.001).

In this study, the relationship between the changes in sleepiness and systolic/diastolic blood pressure of personnel was investigated (Figure 4). According to this study, the association between changes in sleepiness and systolic/diastolic blood pressure over time is significantly negative (P<0.001).
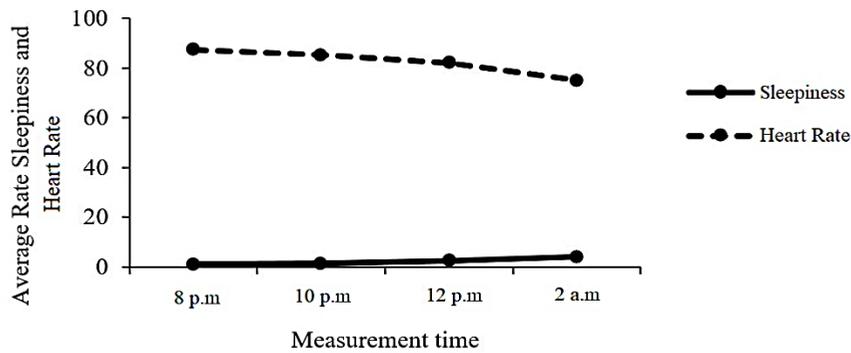

Figure 1. The sleeping changes

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Figure 2. The relationship between the changes in sleepiness and heart rate

Figure 5 shows the relationship between the trend of changes in sleepiness and the number of personnel breathing. According to the results, the association between changes in sleepiness and the number of breaths over time is significantly negative (P<0.01).

To investigate the changes in sleepiness with demographic characteristics among night shift employees, we used repeated measures analysis (Table 1). The results showed that changes in sleepiness over time were statistically significant for night shift personnel (P<0.001), while a significant relationship was not found between demographic variables and the trend of sleepiness.

4. Discussion

The findings of this study showed no significant relationship between demographic variables, including age, gender, marital status, level of education, smoking status, work experience, and body mass index with sleepiness. It can be concluded that because the night shift rehabilitation staff in the hospital were not fully at work, no significant relationship was observed between demographic variables and the sleepiness trend. In this regard, the study of Golbabaei et al. [8] on night shift

workers showed no significant relationship between sleepiness and marital status, education, and smoking. In their study, the correlation between sleepiness and the variables of age, body mass index, and work experience of workers was not significant, which is consistent with the results of our study [8]. Also, In the study of Ansari [9], which investigated sleepiness in nurses, sleepiness status had no significant relationship with age, confirming our findings. However, in the study of Karchani et al. [10] on night shift drivers, it was shown that there is a significant positive relationship between sleepiness and age (r=0.613; P<0.001) and body mass index (r=0.275; P=0.009), which is not consistent with the results of this study. This inconsistency might be due to the study population. Usually, in industries, people with lower levels of education are selected and employed as night shift workers. In the hospital, however, the night shift selection is regardless of the level of education and is based on the staff's job description. Also, in the study by Ghaffari [11], a statistically significant difference was observed between daily sleepiness and age and body mass index in women with hypertension.
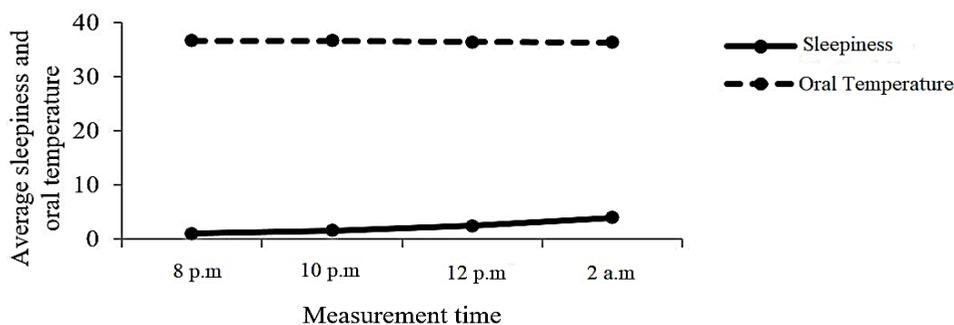

Figure 3. The relationship between the changes in sleepiness and oral temprature
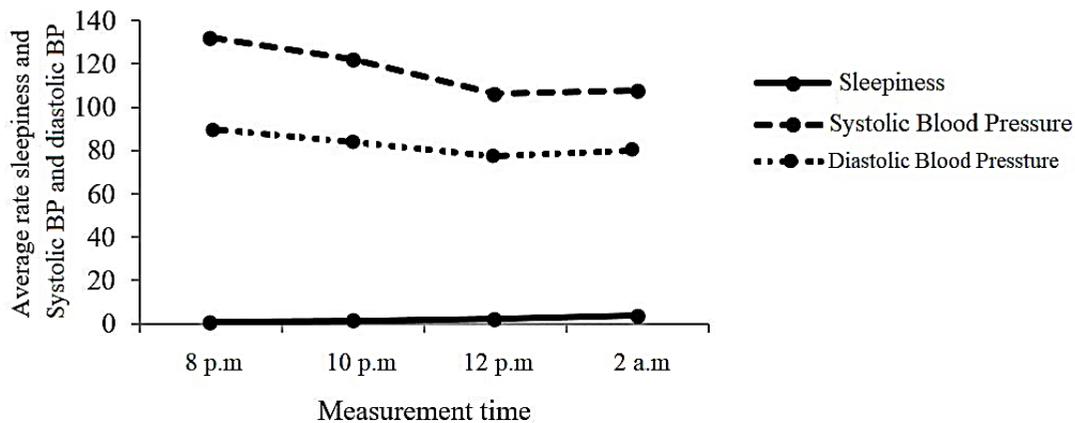
Figure 4. The relationship between the changes in sleepiness and systolic/diastolic blood pressure

In this study, no significant difference was observed in sleepiness between smokers and non-smokers, which is consistent with a study by Farvaresh [12] on shift workers working in the automobile industry. In general, sleep disorders and the prevalence of sleepiness in industrial workers are positively related to body mass index; thus, with the increase in body mass index, the prevalence of sleepiness increases. People with a high body mass index are more likely to get tired early due to being overweight and needing more sleep to recover their strength [10]. The studies by Mokarami et al. [13] and Hojati et al. [14] did not show a significant relationship between marital status and sleep quality, which is in line with this study's results. A factor that can explain the lack of significance between marital status and sleepiness is the effect of social factors on sleepiness. Also, in another study by Karchani et al. on night shift drivers, no significant relationship was observed between marital status and sleepiness [10].

In this study, no significant relationship was found between sleepiness and gender. In contrast, in the study of Ansari [9], the relationship between gender and night sleep quality was significant and female nurses had lower sleep qualities, which might be due to their responsibilities at home and child care; also, they have higher stress compared to men. However, in the study of Salehi, the relationship between gender and sleep quality was insignificant. Similarly, Mirmohammadi [15] showed no significant relationship between gender and sleepiness in nurses, which is in line with the findings of this study.

The results of the repeated measures test showed that changes in sleepiness over time were statistically significant for night shift personnel, which were in line with the Poursadeghiyan study [16]. Also, Karchani et al. [17] and Khammar et al. [18] showed that the highest rate of sleepiness is during 2 AM, 4 AM, and 6 AM, which is consistent with the findings of this study. In the study of Farvaresh [12], the rate of sleepiness in the night shift was higher than in the morning shift and was also statistically significant. One of the reasons for the increase in sleepiness among employees after 2 AM is the uniformity of the work environment and the increased secretion of melatonin.
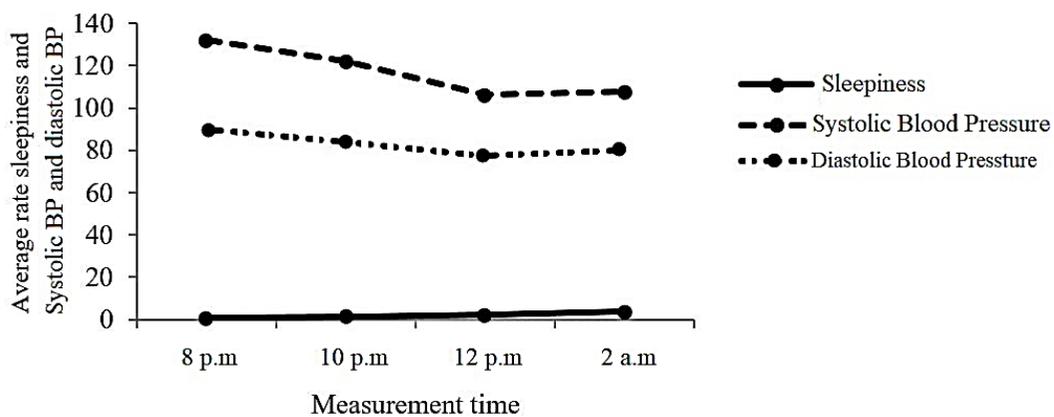

Figure 5. The relationship between the changes in sleepiness and respiratory rate

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Based on the results of repeated measures analysis, the amount of sleepiness of personnel due to increasing time has increased and had significant changes, so that at 2 AM, the highest sleepiness was recorded for personnel, which is consistent with other studies, which have shown that the highest rate of sleepiness during the night shift is during the hours after 2 AM [19]. Khammar et al. [18], Moradi et al. [20], Øyane et al. [21], Zare et al. [22], and Mirmohammadi et al. [15] also achieved similar results.

The study results indicated that the relationship between sleepiness and heart rate was significant and inverse; with increased sleepiness, the heart rate decreased so that the lowest heart rate was reported in the last hour. Khammar et al. [23] reported similar results. Also, in the study of Mazloumi et al., the relationship between sleepiness and heart rate, and respiration were significant, which is consistent with our study [24].

Also, in this study, the relationship between sleepiness and oral temperature was significant and negative. Accordingly, the oral temperature decreased with increasing time, although small but significant. This finding is in line with the study of Khaleghi et al. [25], Golbabaei et al. [8], and Poursadeghian et al. [26].

According to our results, the systolic and diastolic blood pressure decreased by increasing time until midnight, while at 2 AM, the mean blood pressure was slightly increased. However, these changes in the final hours did not significantly change the reverse trend of lowering blood pressure. This result is consistent with the findings of Moradi et al. [20]. Goldstein et al. [27] found that drowsier employees were more likely to be diagnosed with high blood pressure. Also, in a meta-analysis by Wang et al. [28], it was shown that sleepiness is a risk factor for hypertension, and this association is higher in women than men, which is in line with our findings.

Previous studies examining the relationship between shift work and blood pressure had similar conclusions. Nakata et al. [29] evaluated 5338 employees of the steel industry in Japan and showed that shift work is one of the risk factors for hypertension. Ohida et al. [30] in Japan also showed that shift work could increase systolic blood pressure among employees.

Although a few studies have examined the association between vital signs and the trend of sleepiness [23], all the studies that evaluated the trend of sleepiness overtime during the night shift concluded that staff performance was significantly reduced due to their sleepiness; this issue can affect the health of the staff as well as the patients.

5. Conclusion

According to the study findings, the impact of increased sleepiness on physiological parameters can be an important, influential, and damaging factor in the performance of night shift personnel in the hospital. Future studies on the impact of physiological changes on the cognitive performance of night shift employees are suggested. Considering the importance of this issue, solutions such as employing young and fresh forces, voluntary selection, and having regular rotation programs to increase the efficiency and productivity of staff are suggested.

Our study had some limitations. One of the limitations was that sleepiness was measured by a subjective method and based on the individual's self-expression. As a result, staff dissatisfaction and fear of the correct answer might affect their responses. Therefore, the participants were reassured that the questionnaires remained anonymous and that their information was completely confidential.

Ethical Considerations

Compliance with ethical guidelines

This study was conducted according to IR.USWR.REC.1397.069 ethical guidelines, and participants were assured of the confidentiality of their information.

Authors' contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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