Original Research

Sleep Quality and Restless Legs Syndrome among Health-care Workers: Shift Workers and Non-shift Workers

Zahra Banafsheh Alemohammad[1*], Seyed Mohammad Esmaeil Taghavi[1], Akbar Sharifian[2]

[1.] *Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran*
[2.] *Occupational Medicine Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran*

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Abstract

Background and Objective: Restless legs syndrome (RLS) is a sleep disorder with an association to sleep quality. We investigated the sleep quality in patients with RLS among health-care workers with or without shift work.

Materials and Methods: All female health-care workers (n = 540) in four educational hospitals were enrolled in this cross-sectional study. International RLS Study Group (IRLSSG) questionnaire, IRLSSG Rating Scale, Pittsburgh Sleep Quality Index (PSQI), and a data collection sheet including demographic characteristics and disorders related to secondary RLS were completed by study participants.

Results: The mean ± standard deviation (SD) age of the participants was 32.0 ± 6.8 years. The mean ± SD PSQI scores were 9.03 ± 3.29 and 7.30 ± 3.67 in RLS-positive and RLS-negative shift workers (P = 0.002), respectively. The mean ± SD PSQI scores were 7.76 ± 3.66 and 6.10 ± 3.15 in RLS-positive and RLS-negative non-shift workers (P = 0.005), respectively.

Conclusion: Health-care workers have poor sleep quality aggravated with both RLS and shift work. RLS-positive female patients are at increased risk of poor sleep quality in both shift workers and non-shift workers with the worst score of PSQI questionnaire in shift workers.

Keywords: Restless legs syndrome; Shift work; Pittsburgh Sleep Quality Index

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Introduction

Restless legs syndrome (RLS), a sensory-motor sleep disorder, is an important cause of significant sleep disruption and can be diagnosed based on clinical criteria (1). The clinical features of RLS were the first characterized in the 1940s and were developed by the International RLS Study Group (IRLSSG) (2). Four cardinal manifestations for the diagnosis of RLS are: (1) an urge to move the limbs (especially legs), usually associated with unpleasant sensation; (2) worsening of symptoms at rest; (3) symptom relief by movement partially or totally; (4) worsening appearance later in the evening or at night (3). The severity of RLS symptoms can be evaluated by standardized rating scales (4).

Many biological activities such as patterns of core body temperature, hormone production, and sleep are presented in the circadian rhythms. Shift work, as a risk factor for disturbing circadian rhythms, can be responsible for many health problems (5). Circadian pattern in RLS symptoms may be affected by the disturbance of the circadian rhythm

***Corresponding author**: Z. B. Alemohammad, Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran.*
Tel: +982155460184, Fax: +982155460184
Email: alemohammadz@yahoo.com

in shift workers (2). There are only a few studies regarding association between shift work and RLS symptoms. In previous studies, there were some discrepancies in RLS prevalence rates due to the different targeted populations and diagnostic criteria (2, 6).

The purpose of this study was to investigate sleep quality among health-care workers with or without shift working in terms of the RLS symptoms and severity.

Materials and Methods

This was a cross-sectional study conducted in four educational hospitals located in Tehran, the capital city of Iran, between February and November 2013. All female health-care workers in those hospitals (n = 730) were enrolled in this study. No specific inclusion criteria were used except for female gender. We explained the objectives of the study, made it clear that participation was voluntary, and obtained informed consent from all the participants.

Each participant received a self-administered data collection sheet with questions on age, smoking habits, working history, drug history especially about medications for mental health conditions that could potentially exacerbate RLS, and medical history for anemia, diabetes mellitus, chronic kidney disease, Parkinson's disease, rheumatologic diseases, and pregnancy. IRLSSG questionnaire, IRLSSG Rating Scale and Pittsburgh Sleep Quality Index (PSQI) were used in this study. The participants who responded positively to all of the four questions of IRLSSG questionnaire were considered to have RLS (1). The severity of RLS was determined as mild ($\leq$ 10 in IRLSSG rating scale), moderate (11-20), severe (21-30), and very severe (31-40) (7, 8). Sleep quality was evaluated by the Persian version of the PSQI questionnaire, which has seven components (9).

The PSQI includes the following components: C1 (sleep quality), C2 (sleep latency), C3 (sleep duration), C4 (habitual sleep efficiency), C5 (frequency of sleep disturbance), C6 (use of sleeping medication), and C7 (daytime dysfunction). Summation of these components produces the total PSQI score. The scores of each component range from 0 (no difficulty) to 3 (severe difficulty) resulting in a total PSQI score of 0-21 with a higher score representing poorer sleep quality. Those with a PSQI score $\geq$ 5 are considered to have poor sleep quality.

Descriptive statistics were expressed as mean ± standard deviation (SD) and differences between continuous variables with equality of variances and normal distributions were calculated using Student's t-test. The chi-square test was applied to compare categorical data. Finally, binary logistic regression (LR) analysis was performed using the backward: LR method to evaluate associations between the presence of RLS and other variables. The statistical analysis was performed using SPSS (Version 16.0; SPSS, Inc., Chicago, IL, USA) for Windows, and a $P < 0.050$ was considered significant.

Results

In total, 540 members (74%) of educational hospitals in Tehran University of Medical Sciences, completed the questionnaires. The mean ± SD age of the participants was 32.0 ± 6.8 ranging from 21 to 56 years. The mean ± SD working years was 8.23 ± 6.50 ranging from 1 to 29 years. Clinical characteristics are summarized in table 1.

Table 1. Clinical characteristics in female health-care workers

Characteristics	All health-care workers n = 540 (%)	Shift workers n = 315 (%)	Non-shift workers n = 225 (%)	OR (95% CI)
PSQI score ≥ 5	410 (75.9)	253 (80.5)	157 (69.9)	1.78 (1.1-2.7)
RLS-positive	102 (18)	61 (19.4)	41 (17.6)	1.1 (0.7-1.7)
Using drugs	68 (12)	34 (10.8)	34 (14.6)	0.7 (0.4-1.2)
Smoking	6 (1)	2 (0.5)	4 (1.5)	0.36 (0.06-2)
Having diseases	87 (16)	47 (14.9)	40 (17.3)	0.84 (0.53-1.3)
Pregnant	14 (3)	6 (1.9)	8 (3.4)	0.54 (0.18-1.6)
Being a nurse	297 (55)	249 (79.6)	48 (21.1)	14.5 (9.6-22.2)

RLS: Restless legs syndrome, PSQI: Pittsburgh Sleep Quality Index, Using drugs: Medications use for mental health conditions that could potentially exacerbate RLS, Having diseases: Anemia, diabetes mellitus, chronic kidney disease, Parkinson's disease, rheumatologic diseases, CI: Confidence interval, OR: Odds ratio

The mean ± SD PSQI score was 7.1 ± 3.5 ranging from 1 to 18. Splitting the data to shift workers and non-shift workers and comparing sub-groups of RLS-negative and RLS-positive revealed that differences in total PSQI score among RLS-positive and RLS-negative participants were statistically significant in both shift workers and non-shift workers. The score of each component of PSQI questionnaire in shift workers and non-shift workers is shown in table 2.

Dividing the data to RLS-negative and RLS-positive groups, and comparing sub-groups of shift workers and non-shift workers revealed that in RLS-negative shift workers and non-shift workers the PSQI scores were 7.30 and 6.10, respectively (P = 0.001). In RLS-positive shift workers and non-shift workers the PSQI scores were 9.02 and 7.76, respectively (P = 0.092).

Among 102 members with RLS, 10 (10%) had mild RLS severity, 50 (49%) had moderate, 35 (34%) had severe, and 7 (7%) had very severe disease. The scatter diagram of RLS severity and PSQI score among non-shift workers and shift workers is presented in figures 1 and 2, respectively.

The LR analysis on the potentially associated factors for the RLS group was performed with the following seven variables: age, shift work, using specific drugs, smoking, diseases associated with RLS, pregnancy, and PSQI score. Among these, shift work, using specific drugs, smoking, diseases associated with RLS, and pregnancy were treated as categorical variables.

Table 2. The score of each component of PSQI questionnaire in RLS-positive and RLS-negative patients among shift workers and non-shift workers

PSQI score	Shift workers		P value	Non shift workers		P value
	RLS + Mean ± SD	RLS − Mean ± SD		RLS + Mean ± SD	RLS − Mean ± SD	
C1	1.750 ± 0.704	1.330 ± 0.812	< 0.001	1.400 ± 0.810	1.090 ± 0.752	0.022
C2	1.720 ± 1.065	1.380 ± 1.018	0.025	1.110 ± 0.863	0.830 ± 0.852	0.070
C3	1.140 ± 1.109	0.960 ± 1.068	0.250	1.450 ± 0.959	1.180 ± 0.935	0.100
C4	0.760 ± 1.122	0.630 ± 1.001	0.370	0.600 ± 0.955	0.400 ± 0.794	0.230
C5	1.410 ± 0.559	1.140 ± 0.512	< 0.001	1.450 ± 0.504	1.030 ± 0.494	< 0.001
C6	0.300 ± 0.641	0.250 ± 0.663	0.650	0.220 ± 0.480	0.350 ± 0.767	0.185
C7	1.980 ± 0.854	1.700 ± 0.923	0.020	1.780 ± 0.947	1.360 ± 0.923	0.120
Global	9.03 ± 3.29)	7.30 ± 3.67	0.002	7.76 ± 3.66	6.10 ± 3.15	0.005
	n (%)	n (%)	OR (95% CI)	n (%)	n (%)	OR (95% CI)
PSQI score ≥ 5	50 (96.2)	169 (76.8)	7.5 (1.77-32)	30 (78.9)	114 (67.9)	1.77 (0.76-4.1)

RLS+: RLS-positive patients, RLS−: RLS-negative patients, SD: Standard deviation, PSQI: Pittsburgh Sleep Quality Index, C1: Sleep quality, C2: Sleep latency, C3: Sleep duration, C4: Habitual sleep efficiency, C5: Frequency of sleep disturbance, C6: Use of sleeping medication, C7: Daytime dysfunction, CI: Confidence interval, OR: Odds ratio

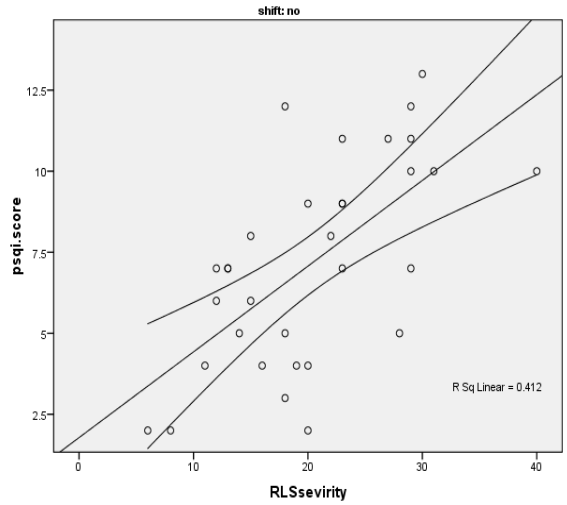

Figure 1. Linear regression of the restless legs syndrome severity and Pittsburgh Sleep Quality Index score in non-shift workers. The R^2 is 0.412, P < 0.001

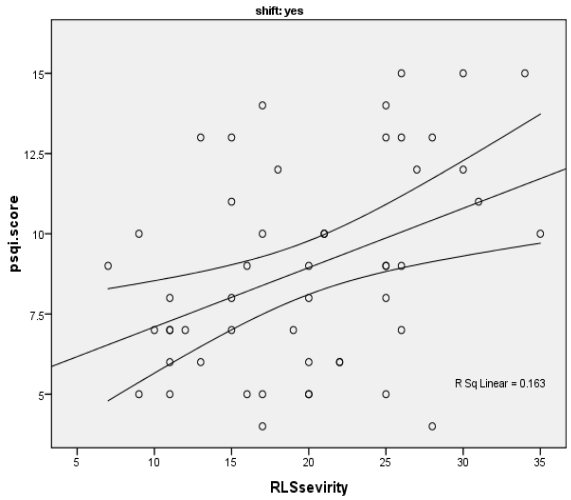

Figure 2. Linear regression of the restless legs syndrome severity and Pittsburgh Sleep Quality Index score in shift workers. The R^2 is 0.163. P = 0.003

The LR analysis revealed that the RLS was significantly associated only with the PSQI score (odds ratio = 1.14, P < 0.001).

Discussion

This study investigated the sleep quality in female health-care workers in terms of RLS and shift work. We found an elevated risk of poor sleep quality in female health-care workers (PSQI score ≥ 5: 75.9%) with a more significant elevation in shift workers. Overall, the mean PSQI score was 7.1 characterizing sleep qualities as poor. The previous studies on health-care workers have reported the same results, underlining the requirement of revision of working schedules in hospitals (10, 11). Yazdi et al. (6) conducted a study to compare sleep disorders between male shift workers and non-shift workers employed in a textile factory. They found that 20.4% of shift workers and 10.3% of non-shift workers had poor sleep quality. Consistent with the current results that the study reported a significant increase of poor sleep quality in shift workers. However, the prevalence of poor sleep quality in both shift workers and non-shift workers was much lower than this study. This discrepancy could be due to different study population regarding gender and occupation.

Shift workers with RLS presented higher scores significantly for sleep quality (C1), sleep latency (C2), frequency of sleep disturbance (C5), and daytime dysfunction (C7). Non-shift workers with RLS presented the higher scores significantly for sleep quality (C1) and frequency of sleep disturbance (C5). Occupational performance is mainly affected by daytime dysfunction. Therefore, the results of this study suggest that shift working exclusive of RLS is responsible for performance deficit as indicated in some previous studies (6, 12).

Studies conducted in different populations such as patients with glomerulopathy, chronic obstructive pulmonary disease, and hemodialysis patients revealed that RLS-positive patients were at increased risk of poor sleep quality (13-15). In this study, overall PSQI score was higher in RLS patients in both shift workers and non-shift workers. However, comparing RLS-positive and

RLS-negative patients, a number of patients with poor sleep quality (PSQI score ≥ 5) were greater significantly only among shift workers (Table 2).

Linear regression analysis of the RLS severity and PSQI score in non-shift workers resulted in a graph with a greater slope than in shift workers (Figures 1 and 2).

Regarding the R^2, PSQI score was better predicted by RLS severity in non-shift workers. Because in shift workers, many other factors may be also responsible for poor sleep quality. Misalignment of the circadian rhythm and sleep-wake schedule in shift workers could result in depression, tension, and tiredness as mentioned in the previous studies (6, 16).

RLS prevalence is reported to increase with age (17). Whittom et al. (18) suggested that more than one pathological process might be responsible in RLS. Genetic factors, iron deficiency, and peripheral neuropathy are some of the associated factors in the pathogenesis of RLS (19, 20). Inconsistent with previous results, in the present study, the LR analysis on the associated factors for the RLS group revealed no significant association except for the PSQI score. This could be due to the fact that we assessed those associated factors with a self-report data collection sheet instead of laboratory tests.

One of the limitations of this study is that self-reporting and subjective methods may have resulted in less accuracy. Moreover, with the cross-sectional design, we could not evaluate the cause-effect relationship. All of the participants in this study were female, so we could not generalize the results to all of the health-care workers. Future research may benefit from using methodologies other than cross-sectional design, increasing in sample size, and investigating the scores of patients after RLS treatment.

Conclusion

It can be concluded that female health-care workers have poor sleep quality aggravated with both RLS and shift work. RLS-positive female patients are at increased risk of poor sleep quality in both shift workers and non-shift workers, with the worst scores of PSQI questionnaire among shift workers.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

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References

1. Allen RP, Picchietti D, Hening WA, et al. Restless legs syndrome: diagnostic criteria, special considerations, and epidemiology. A report from the restless legs syndrome diagnosis and epidemiology workshop at the National Institutes of Health. Sleep Med 2003; 4: 101-19.

2. Sharifian A, Firoozeh M, Pouryaghoub G, et al. Restless Legs Syndrome in shift workers: A cross sectional study on male assembly workers. J Circadian Rhythms 2009; 7: 12.

3. Walters AS. Toward a better definition of the restless legs syndrome. The International Restless Legs Syndrome Study Group. Mov Disord 1995; 10: 634-42.

4. Allen R, Oertel W, Walters A, et al. Relation of

the international restless Legs Syndrome study group rating scale with the clinical global impression severity scale, the restless legs syndrome 6-item questionnaire, and the restless legs syndrome-quality of life questionnaire. Sleep Med 2013; 14: 1375-80.

5. Guo Y, Liu Y, Huang X, et al. The effects of shift work on sleeping quality, hypertension and diabetes in retired workers. PLoS One 2013; 8: e71107.

6. Yazdi Z, Sadeghniiat-Haghighi K, Loukzadeh Z, et al. Prevalence of sleep disorders and their impacts on occupational performance: a comparison between shift workers and nonshift workers. Sleep Disord 2014; 2014: 870320.

7. Abetz L, Arbuckle R, Allen RP, et al. The reliability, validity and responsiveness of the International Restless Legs Syndrome Study Group rating scale and subscales in a clinical-trial setting. Sleep Med 2006; 7: 340-9.

8. Walters AS, LeBrocq C, Dhar A, et al. Validation of the International restless Legs Syndrome Study Group rating scale for restless legs syndrome. Sleep Med 2003; 4: 121-32.

9. Farrahi Moghaddam J, Nakhaee N, Sheibani V, et al. Reliability and validity of the Persian version of the Pittsburgh Sleep Quality Index (PSQI-P). Sleep Breath 2012; 16: 79-82.

10. De Martino MM, Abreu AC, Barbosa MF, et al. The relationship between shift work and sleep patterns in nurses. Cien Saude Colet 2013; 18: 763-8.

11. Zverev YP, Misiri HE. Perceived effects of rotating shift work on nurses' sleep quality and duration. Malawi Med J 2009; 21: 19-21.

12. Kosmadopoulos A, Sargent C, Darwent D, et al. The effects of a split sleep-wake schedule on neurobehavioural performance and predictions of performance under conditions of forced desynchrony. Chronobiol Int 2014; 31: 1209-17.

13. Cavalcante AG, de Bruin PF, de Bruin VM, et al. Restless legs syndrome, sleep impairment, and fatigue in chronic obstructive pulmonary disease. Sleep Med 2012; 13: 842-7.

14. Chavoshi F, Einollahi B, Sadeghniiat-Haghighi K, et al. Prevalence and sleep related disorders of restless leg syndrome in hemodialysis patients. Nephrourol Mon 2015; 7: e24611.

15. Liborio AB, Santos JP, Minete NF, et al. Restless legs syndrome and quality of sleep in patients with glomerulopathy. BMC Nephrol 2013; 14: 113.

16. Drake CL, Roehrs T, Richardson G, et al. Shift work sleep disorder: prevalence and consequences beyond that of symptomatic day workers. Sleep 2004; 27: 1453-62.

17. Hening W, Walters AS, Allen RP, et al. Impact, diagnosis and treatment of restless legs syndrome (RLS) in a primary care population: the REST (RLS epidemiology, symptoms, and treatment) primary care study. Sleep Med 2004; 5: 237-46.

18. Whittom S, Dauvilliers Y, Pennestri MH, et al. Age-at-onset in restless legs syndrome: a clinical and polysomnographic study. Sleep Med 2007; 9: 54-9.

19. Birinyi PV, Allen RP, Hening W, et al. Undiagnosed individuals with first-degree relatives with restless legs syndrome have increased periodic limb movements. Sleep Med 2006; 7: 480-5.

20. Lopes LA, Lins CM, Adeodato VG, et al. Restless legs syndrome and quality of sleep in type 2 diabetes. Diabetes Care 2005; 28: 2633-6.