Original Research

Sleep Quality in Shift Workers of Offshore Petroleum Industries

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Abstract

Background and Objective: Shift work, especially at nights, has negative health outcomes for the workers, their families, and affiliated organizations. Working at night is associated with shortened and disturbed sleep, daytime sleepiness, fatigue, impaired performance, and increased risk of accidents. In this study, we aimed to evaluate sleep quality in different shift schedules of Iranian workers of offshore drilling rigs.

Materials and Methods: One hundred and ninety two offshore workers of two oil rigs were enrolled in this cross-sectional study. They were asked to fill out the validated and reliable Persian version of Pittsburg Sleep Quality Index (PSQI). Data regarding age, marital status, education level, smoking, shift work schedule, and body mass index (BMI) were recorded as well.

Results: Mean age and mean work experience of the participants were 37.0 ± 9.3 and 10.0 ± 8.6 years, respectively. Fifty six participants (29.2%) were fixed day shift workers, 111 (57.8%) were swing shift workers (7 days/7 nights), 6 (3.1%) were fixed night shift workers, and 19 (9.9%) were standby shift workers. Mean PSQI score of all workers was 6.73 ± 3.61, and in 69% of the subjects, total score of PSQI was ≥ 5. Night shift workers had greater score of PSQI than other three groups of shift workers.

Conclusion: This study showed that more than half of oil rig workers had poor sleep quality with the highest score among fixed night shift workers. This warrants comprehensive evaluation of the studied participants in terms of sleep disorders and related risk factors. Investigation of contributing occupational and environmental risk factors is also recommended.

Keywords: Oil and gas industry; Shift work schedule; Sleep

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Introduction

Shift work, especially night work, has negative health outcomes for shift workers, their families, and relevant organizations. Working at night is associated with shortened and disturbed sleep, daytime sleepiness, fatigue, impaired performance, and increased risk of accidents (1). In night shift workers, stages 2 and rapid eye movement (REM) of sleep are affected (2, 3). Shift workers suffer from various health-related problems such as gastrointestinal and cardiac diseases (4). The mechanism of the association between shift work and poor health is complex, and related to several biological, psychological, and social factors (5).

The offshore petroleum industry has high prevalence of shift working. Offshore workers routinely spend at least two working weeks followed by a period of shore leave. Standard shift duration during the offshore weeks includes 12-hours work alternating with 12-hours off-shift. Waage et al. reported poorer sleep quality and more health complaints among offshore workers with shift work than the ones without shift work (5). Long working hours and limited exposure to sunlight for indoor workers are some of the asso-

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ciated risk factors for developing sleep problems in this population (6). This warrants strict medical examination standards, and regular medical evaluations regarding sleep problems to assure fitness for working among offshore workers (7, 8).

Limited epidemiological studies are available regarding sleep problems among Iranian offshore workers that warrant more in-depth studies on sleep problems in this population. Lack of data along with importance of sleep issues, as one of the components of healthy life and better occupational performance in offshore workers, highlights an urge for conducting studies with focus on sleep problems. Accordingly, this study aimed to assess sleep quality in Iranian offshore drilling rigs workers, and the effect of different shift schedules on their sleep quality.

Materials and Methods

Study design and participants: This cross-sectional study was conducted on 192 offshore workers of two oil rigs. The study was approved by ethics' committee of the Tehran University of Medical Sciences, Tehran, Iran. All participants signed the informed consent prior to enrollment. Workers who had at least one year of work experience at offshore drilling oil rigs at Persian Gulf, and two weeks shift followed by two weeks rest onshore were recruited. Workers with history of medical disease (cardiopulmonary, renal, or liver diseases), using sedative-hypnotic agent, or history of psychosocial disturbance were excluded from the study.

Pittsburg Sleep Quality Index (PSQI): PSQI is a self-administered questionnaire, which consists of 18 questions generating seven component scores of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component score ranges from 0-3 (0, the lowest score in each component and 3, the highest score). A validated and reliable Persian version of this questionnaire was applied in the current survey. The total score ranges from 0-21. While higher scores indicate poorer sleep quality; a total score of equal or more than 5 indicates impaired sleep quality (9). Data regarding age, marital status, education level, smoking behavior, type of the shift work, room occupancy, and body mass index (BMI) were also recorded.

Statistical analysis: All data were presented as number (percent) for categorical variables and mean [standard deviation (SD)] for continuous variables. The difference between qualitative and quantitative variables was analyzed by using chi-square and Mann-Whitney U tests, respectively. All analysis was done using SPSS software (version 18.0, SPSS Inc., Chicago, IL, USA), and P value of less than 0.05 was considered statistically significant.

Results

The mean (± SD) age and work experience were 37.0 ± 9.3 and 10±8.6 years, respectively. Fifty-six participants (29.2%) were fixed day shift workers, 111 (57.8%) were swing shift workers (7 days/7 nights), 6 (3.1%) were fixed night shift workers, and 19 (9.9%) were standby shift workers. Night shift workers had greater score of PSQI than other three groups of shift workers.

In our sample, 169 (88.0%) and 34 (17.7%) participants were married and cigarette smoker, respectively. Education level in 155 participants (80.7%) was high school diploma or above. Of 192 participants, 124 (64.6%) were satisfied with their job.

Mean PSQI score of all workers was 6.73 ± 3.61. In 69.0% of the subjects, PSQI was ≥ 5. Mean PSQI score of the workers with different shifts is shown in table 1.

Table 1. Mean PSQI score of workers of different shifts

Shift Type	Mean (SD)
Fixed day shift	6.05 (3.05)
Seven days/seven nights shift	6.90 (3.89)
Fixed night shift	8.50 (4.72)
Standby shift	6.89 (3.78)

SD: Standard deviation; PSQI: Pittsburg Sleep Quality Index

As shown in table 2, younger workers were significantly more likely to report poor sleep quality than older workers (76.0% versus 62.0%, respectively, P = 0.03). Workers who had poor sleep quality found to be significantly less satisfied with their job (P = 0.01). Moreover, the participants who requested for increased rest time had poorer sleep quality in comparison with the ones who did not have this request (P < 0.01).

Higher educated and single participants had higher PSQI score although the association was not statistically significant. Among different shift schedules, standby and fixed night shift workers were more likely to report impaired sleep quality (P > 0.05). Workers at oil rig B reported significantly better sleep quality than workers in oil rig A (60.0% versus 75.7%, respectively, P = 0.02) (Table 2).

Table 2. Distribution of impaired sleep quality according to various characteristics of the studied workers

Variable		Impaired sleep quality (%)	P-value
Age (year)	< 33	85 (76.0)	0.03*
	> 33	107 (62.0)	
BMI (kg/m^2)	< 30	189 (69.5)	0.98
	≥ 30	3 (66.7)	
Smoking	Yes	32 (69.7)	0.91
	No	157 (68.9)	
Oil Rig	A	111 (75.7)	0.02*
	B	81 (60.0)	
Education	High school diploma or more	95 (66.9)	0.93
	Less than high school diploma	97 (78.4)	
Job Satisfaction	Yes	68 (62.9)	0.01*
	No	124 (80.6)	
Marital status	Single	169 (87.0)	0.06
	Married	23 (66.7)	
Shift Type	Fixed day	57 (66.1)	
	Seven days/seven nights	109 (66.6)	0.34
	Fixed night	6 (83.3)	
	Standby	18 (78.9)	
Room Occupancy	One person (manager)	10 (80.0)	0.20
	2 persons	13 (53.8)	
	3 persons	8 (62.5)	
	4 persons	105 (68.3)	
	> 4 persons	18 (77.8)	
	Others	37 (70.0)	
Request for in increased rest time	Yes	118 (77.0)	< 0.01*
	No	74 (48.1)	

BMI: Body mass index
Impaired sleep quality: Pittsburg Sleep Quality Index (PSQI) score ≥ 5
*: Statistically significant

Discussion

Current study indicated that more than half of oil rig workers suffer from impaired sleep quality based on their PSQI score. The mean PSQI score was higher in fixed night shift workers. Frequency of workers with impaired sleep quality was significantly higher among workers in younger age groups, without job satisfaction, higher request for shore leaves, and located in different oil rigs.

Healthy shift working is a matter of issue in offshore industries. Adaptation to night work takes place fairly in offshore workers, while workers with rotational shift works are affected more. Sleepiness at work is one of the most complaints of shift workers, and is associated with loss of productivity, increased risk of errors, and occupational accidents (10, 11). Working offshore at an oil rig is related with maladjustment both 24-hour circadian rhythm and the environmental condition, and unique place where they are located in. In studied oil rigs, most workers do not leave the rigs between shifts; so they are more at risk of developing problems related to shift work, because they lack family support and are less provided with well-designed rest areas. A recent study indicates that sleeping environment has significant association with subjects' sleep quality and even their polysomnographic features such as apnea-hypopnea index (12). This newly raised issue highlights the need for detailed evaluation of sleeping environment, as well as air polluting particles of studied oil rigs with subsequent action plans. Different types of shift schedules have also a substantial contribution to sleep quality of shift workers at oil rigs. The occupational setting of these workers is quite different from the others; they are not with their families after the shift, and subsequently they lack their support according to their shift schedule. Additional family contacts may be more impaired among the ones who work at the daylight times, or work at night and sleep in the day after the shift. These issues make the effect of a shift schedule more complicated besides the known maladjustment that workers develop because of their circadian rhythms.

In Waage et al. study (5), mean PSQI score in day workers was 4.49 ± 2.26, while in this study, mean PSQI score was 6.05 ± 3.05 in day shift workers. These results show that sleep quality was more impaired in our study participants, which requires more investigation on existing sleep

problems and shift schedules. Studied oil rigs might be poorly equipped and polluted sleeping environment. Day workers are expected to suffer from lesser sleep problems; however our study participants suffered from poor sleep quality. Other primary sleep problems also have to be kept in mind, and study participants need more medical screening, evaluation, and management regarding sleep disordered breathing, psychological issues, and the other sleep and medical disorders that are prevalent among shift workers. The other source of observed difference between results of present and previous reports are different study settings, meteorological condition of the studied rigs, cultural issues and perceptions of sleep problems among our participants.

Gibbs et al. found that oil rig workers adapted to the night shift during the first week while there was variations in adaptation during the day shift (13). Along with present study, reported PSQI score in Gibbs et al. study (13) was higher in night shift workers while in Bjorvatn et al. study (10), both day and night shifts were worse, and in some cases by considering quality of day and total sleep time, the day shift workers had more impaired sleep. These differences could be due to various methodological issues for evaluation of sleepiness and different sample sizes. In accordance to Parkes (8, 14), in our study risk factors such as age, that adversely affect night-shift sleep among onshore workers, did not act as a risk factor for poor sleep. However, against Parkes studies (8, 14), in our findings, smoking did not affect sleep quality of offshore workers. In a systematic review, Fossum et al. showed that shift workers had more sleep issues than day workers, which were similar to our study results (15).

Our results also showed that the frequency of participants with impaired sleep quality were significantly higher among offshore workers without job satisfaction. Axelsson et al. reported that satisfaction with the shift schedule was an indicator of coping with shift work and sleep-wake problems in dissatisfied workers, and it was related to restrained and displaced sleep (16). Some people could tolerate shift work well, while others could not; and this may be source of job dissatisfaction. It has been reported that 1 of 5 workers leaves shift work, and only 10% of them enjoy shift work (17).

As mentioned before, sleeping environment is also considered as important factor in sleep perceived quality (18). In this study, residents of oil rig B with better sleeping environment in the rooms reported better sleep quality. Furthermore, with increasing room occupancy, sleep quality of participants decreased; but the association was not significant that may be due to limited sample size. This finding warrants authorities to have more attention towards sleeping environment of shift workers as an important factor. Surprisingly, managers, who did not share their room with any one, had also poor sleep quality. This matter needs to be elucidated more, as the poor sleep quality in managers may be due to their increased occupational stress or other associating factors.

Several limitations of this study include the limited sample size, and self-reported tool for evaluation of sleep. More comprehensive studies for objective investigation of workers' sleep including actigraphy and polysomnography are recommended.

Conclusion

This study showed that more than half of the studied oil rig workers had impaired sleep quality, and the mean PSQI score was higher in fixed night shift workers. We suggest measurement of environmental and occupational hazards related to poor sleep quality in this population. Furthermore, findings of this study indicate more attention of authorities towards screening and management of sleep disorders and objective assessment of their sleep with actigraphy and or polysomnography if indicated.

Conflict of Interests

Authors have no conflict of interests.

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References

1. Akerstedt T. Shift work and disturbed sleep/wakefulness. Occup Med (Lond) 2003; 53: 89-94.

2. Torsvall L, Akerstedt T, Gillander K, et al. Sleep on the night shift: 24-hour EEG monitoring of spontaneous sleep/wake behavior. Psychophysiology 1989; 26: 352-8.

3. Mitler MM, Miller JC, Lipsitz JJ, et al. The sleep of long-haul truck drivers. N Engl J Med 1997; 337: 755-61.

4. Callister R, Suwarno NO, Seals DR. Sympathetic activity is influenced by task difficulty and stress perception during mental challenge in humans. J Physiol 1992; 454: 373-87.

5. Waage S, Moen BE, Pallesen S, et al. Shift work disorder among oil rig workers in the North Sea. Sleep 2009; 32: 558-65.

6. Harris A, Waage S, Ursin H, et al. Cortisol, reaction time test and health among offshore shift workers. Psychoneuroendocrinology 2010; 35: 1339-47.

7. Hope S, Qverland S, Brun W, et al. Associations between sleep, risk and safety climate: A study of offshore personnel on the Norwegian continental shelf. Safety Science 2010; 48: 469-77.

8. Parkes KR. Mental health in the oil industry: A comparative study of onshore and offshore employees. Psychol Med 1992; 22: 997-1009.

9. Buysse DJ, Reynolds CF 3rd, Monk TH, et al. The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. Psychiatry Res 1989; 28: 193-213.

10. Bjorvatn B, Stangenes K, Oyane N, et al. Subjective and objective measures of adaptation and readaptation to night work on an oil rig in the North Sea. Sleep 2006; 29: 821-9.

11. Waage S, Harris A, Pallesen S, et al. Subjective and objective sleepiness among oil rig workers during three different shift schedules. Sleep Med 2012; 13: 64-72.

12. Lappharat S, Taneepanichskul N, Reutrakul S, et al. Effects of bedroom environmental conditions on the severity of obstructive sleep apnea. J Clin Sleep Med 2018; 14: 565-73.

13. Gibbs M, Hampton S, Morgan L, et al. Adaptation of the circadian rhythm of 6-sulphatoxymelatonin to a shift schedule of seven nights followed by seven days in offshore oil installation workers. Neurosci Lett 2002; 325: 91-4.

14. Parkes KR. Age, smoking, and negative affectivity as predictors of sleep patterns among shiftworkers in two environments. J Occup Health Psychol 2002; 7: 156-73.

15. Fossum IN, Bjorvatn B, Waage S, Pallesen S. Effects of shift and night work in the offshore petroleum industry: A systematic review. Ind Health 2013; 51: 530-44.

16. Axelsson J, Akerstedt T, Kecklund G, et al. Tolerance to shift work-how does it relate to sleep and wakefulness? Int Arch Occup Environ Health 2004; 77: 121-9.

17. 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.

18. Ohayon MM, Chen MC, Bixler E, et al. A provisional tool for the measurement of sleep satisfaction. Sleep Health 2018; 4: 6-12.