

## Shift Work Disorder, Insomnia, and Depression among Offshore Oil Rig Workers

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### Abstract

**Objective:** Numerous offshore jobs require 24-hour tasks, such as in industrial workplaces (eg, oil rigs). The purpose of this study was to assess shift work disorder (SWD), insomnia, daytime sleepiness, and depression among Iranian offshore oil rig workers in different shift schedules.

**Method:** This cross-sectional study was conducted on Iranian offshore oil workers at the Persian Gulf. A questionnaire package consisted of Epworth Sleepiness Scale (ESS), Insomnia Severity Index (ISI), Beck Depression Inventory (BDI-II), and SWD filled. The scores were calculated among different groups of shift schedules (fixed-day, fixed-night, swing and standby shift workers). ISI, BDI-II, and ESS scores were also compared between individuals with or without SWD.

**Results:** A total of 188 participants were recruited in the study, and all were male. The mean age was  $37.06 \pm 9.2$  years. Among different shift schedules, the highest and lowest ISI and ESS scores were related to fixed-night shifts workers and fixed-day shift workers, respectively. ISI, ESS, and BDI mean scores in different shift schedules were not significantly different ( $p$  values = 0.14, 0.57, and 0.93, respectively). SWD was diagnosed in 57 (30.3%) of studied shift workers. The difference between SWD prevalence was not significant between different shift schedules ( $P$  value = 0.13). Workers with SWD had higher ISI, ESS, and BDI-II score ( $P$  values <0.0001, <0.0001, and <0.0001, respectively) and workers without SWD had higher job satisfaction ( $p$  value = 0.04).

**Conclusion:** SWD is considered as a serious health-related issue in Persian Gulf oil rig shift workers. Insomnia, daytime sleepiness, and depression are associated with SWD.

**Key words:** *Depression; Sleepiness; Sleep Initiation and Maintenance Disorders; Shift Work Schedule*

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Numerous jobs require 24-hour tasks, such as industrial workers (eg, oil rigs) and social service workers (eg, health care workers, police officers, and drivers) (1). Shift work is defined as any work occurring outside 7 AM to 6 PM time frame. For 24-hour coverage of workforce, it is necessary to define some scheduled working periods in addition to standard daytime like night shifts, evening shifts, rotating, and permanent shifts (2). In industrial countries, such as the USA and Europe, about 1 in 5 employees work at night shifts (3). When the great number of workforce is engaged in shift working, it is necessary to assess their possible health-related problems. Working in night shift might lead to shift work disorder (SWD), which is defined as at least one-month of daytime sleepiness and insomnia related to recurring shift working in the absence of other medical issues or drug abuse (4). Based on Drake CL et al study, 26.1% of rotating shift workers and 32.1 % of night shift workers suffer from SWD (5).

Circadian rhythm is a 24-hour internal clock that regulates the human body and also adjusts many bodily functions, such as metabolism, hormonal secretion, and cellular proliferation (6). Shift working causes circadian rhythm disturbance, which leads to major health problems, such as metabolic syndrome (7), malignancies (8), heart diseases (9), and psychiatric problems, such as depression (5). Recent studies also indicate the impact of short night sleep duration on the depressive mood disorder (10, 11). In addition, the higher rate of depression in the night shift workers was clearly shown (12).

The importance of shift working and its effects on nocturnal sleeplessness and drowsiness throughout the day have led to studies on various occupations, including nurses (13) and drivers (14) that show higher rates of night sleeplessness and sleepiness during the day (15). Limited studies have investigated shift working and its consequences in oil industries, especially in Middle Eastern countries such as Iran. Offshore oil industry requires 24-hour active workforce. Offshore workers in Iran follow scheduled work shifts consisting of 2 weeks offshore followed by 2 weeks off. Standard offshore shift duration is 12hours per day. The purpose of this study was to assess SWD, insomnia, daytime sleepiness, and depression among Iranian offshore oil workers in different shift schedules. In addition, the relationship between these indices and demographic variables as well as the different prevalence of health-related issues, including insomnia, daytime sleepiness, and depression and job satisfaction among workers with or without SWD, were the goals of this study.

## Materials and Methods

### Study Design and Participants

This cross-sectional study was conducted on Iranian offshore oil workers at the Persian Gulf. All required

information was collected by questionnaires within 3 months in 2 oilrigs of the Persian Gulf. All 188 workers on these oil rigs were entered into the study. All the participants were male and had at least 10-year work experience and scheduled shift work with 2 weeks offshore followed by 2 weeks off work onshore. Of participants, 109 were 7days-7nights (swing) shift worker, 19 were on call (standby shift worker), 54 and 6 had fixed-day shifts and fixed-night shifts, respectively. We excluded workers with a history of mental disorders (under treatment for major depression disorder and bipolar disorder), physical disorders (cardiopulmonary, renal, and liver diseases), sedative-hypnotic and antidepressant medication use. The exclusion criteria were based on the self-report of the participants .

In the current study, all participants were asked about age, marital status, education, smoking, job satisfaction, request for more rest time, and type of oil rig. Weight and height of participants measured and body mass index (BMI) was calculated (kg/m<sup>2</sup>). In addition, all participants completed a valid and reliable Persian version of ESS (Epworth sleepiness scale) and ISI (Insomnia Severity index) questionnaires (17, 18).

### Epworth sleepiness scale

Epworth sleepiness scale (ESS) is a self-reported questionnaire that assesses an individual's daytime sleepiness in specific situations. This scale consists of 8 questions, which uses the Likert scale ranging from 0 to 3, and pooled answers ranging from 0 to 24. The total score over 10 indicates clinically significant daytime sleepiness (16). We used a valid and reliable Persian version of this questionnaire (17).

### Insomnia Severity Index

Insomnia Severity Index (ISI) is a self-administrated scale assessing the nature and severity of insomnia over the past month. This scale evaluates different dimensions of insomnia, including severity of falling sleep, sleep maintenance, and early morning awakening, sleep satisfaction/dissatisfaction, notice ability of sleep problems by others, concern caused by the sleep problems, and interference with daytime functioning. This questionnaire uses 7 items scored on the 5-point Likert scale with the summed scores ranging from zero to 28. The total scores between 8 to 14 as subthreshold insomnia and equal or greater than 14 were interpreted as clinically significant insomnia .

### Beck depression inventory-II

Beck depression inventory-II (BDI-II) is a self-reported scale designed to measure the severity of depression symptoms. Participants were asked to answer 21 questions with the 4-point Likert scale, ranging from zero to 3, which reflects participants' feelings over the past 2 weeks. The total score ranges from zero to 63, with higher scores representing greater depressive mood. Higher total scores show more severe depression (18).

**Shift Work Disorder**

Shift work disorder (SWD) is diagnosed by a self-reported questionnaire that asks the SWD criteria based on the International Classification of Sleep Disorders-3rd Edition (ICSD-3). Excessive sleepiness or insomnia that lasts more than 1 month, without association to neither medication or substance use, nor medical or mental disorder that cause functional impairment is defined as SWD (19).

**Ethics**

This study was conducted in concordance with the World Medical Association Declaration of Helsinki and approved by the ethics committee of Tehran University of Medical Sciences. Before the administration of the questionnaires, the nature and goals of the study was explained to all participants, and they were assured that their responses would be confidential to the research team, and the company would only access to anonymous results as published in this article .

**Statistical Analysis**

Data analysis was performed by IBM SPSS 16 for windows (Chicago, IL, USA). The P value less than 0.05 was considered statistically significant. Descriptive data, one-way ANOVA, independent t test, nonparametric correlations (Spearman’s rho) and chi-square were performed for data analysis. Regression analysis was performed to control the confounder parameters.

**Results**

A total of 188 male oilrig shift workers were recruited in the current study, of whom 81 (42.2 %) were working on oilrig A and the rest on oilrig B. The mean (SD) age and BMI of all participants were 37.06 (9.2) years and 26.5 (3.3) (kg/m<sup>2</sup>), respectively. A total of 169 (88%) of the participants were married and 33 (17.2%) were smoker. Of all the studied workers, 118 (61.5%) and 140 (72.9%) had rest during work time and request for increased rest time, respectively. Also, 155 (81%) had at least a high school diploma, and 51 (26.6%), and 124 (64.6%) had overtime working and job satisfaction, respectively. Among 188 shift workers, 109 (57.7%) were 7days-7nights (swing) shift worker, 54 (28.6%), and 6 (3.2%) had fixed-day shifts and fixed-night shifts, respectively. A total of 19 (10.1%) workers were on call (standby shift worker). The mean scores of ISI, ESS, and BDI-II in all participants were 10.4±5.8, 7.2±4.3 and 9.9±9.3, respectively (Table 1).

The results of data analysis showed that age, body mass index (BMI), smoking, marital status, level of education, and overtime working did not affect the mean score of ISI, ESS, BDI-II scales, significantly. Workers with an increased demand for rest time had more severe insomnia (P value ≤ 0.01) and depression (P value ≤ 0.01) in comparison with the ones not requesting for increased rest time. Findings also showed that employees with higher job satisfaction had lower scores on ISI (P value ≤ 0.01) and BDI-II (P value ≤ 0.01)

scale. However, our results showed no significant BDI-II score difference in single people and those who had overtime working (P values = 0.11 and 0.06, respectively). In addition, those who had at least a diploma degree had a higher ISI and BDI-II score (P values = 0.05 and 0.12, respectively).

Among the different shift schedules, the highest and lowest ISI scores were related to fixed-night shifts workers and fixed-day shift workers, respectively. Similar to ISI score, our results showed the highest and lowest ESS score in fixed-night shifts workers and fixed-day shift workers, respectively. ISI, ESS, BDI mean scores in different shift schedules did not show any significant difference (P values= 0.14, 0.57, and 0.93, respectively) (Table 2).

SWD was diagnosed in 57 (30.3%) of the studied shift workers. According to shift types, SWD was observed in 12 (21.4%) of the fixed-day, 4 (66.7%) of the fixed-night, 34 (30.9%) of the swing, and 6 (31.6%) of the standby shift workers. The difference between SWD prevalence was not significant between different shift schedules (P value = 0.13).

Workers with SWD had higher ISI, ESS, and BDI-II score (P values = <0.0001, <0.0001, and <0.0001, respectively) (Table 3). After adjusting for age and BMI on regression analysis, the difference remained significant (Table 4).

Insomnia and depression were significantly higher in workers with a high demand for increasing rest time during the work-time (P values = 0.003 and 0.001, respectively) and lower job satisfaction (P values = 0.001 and 0.002, respectively). Besides, workers without SWD had significantly higher job satisfaction (P value = 0.04).

**Table 1. Descriptive Statistics of ISI, ESS, and BDI-II Scores**

Questionnaire	Mean±SD	Minimum	Maximum
ISI	10.4±5.8	0	27
ESS	7.2±4.3	0	20
BDI	9.9±9.3	0	48

ISI: Insomnia severity index; ESS: Epworth sleepiness scale; BDI: Beck depression inventory.

**Table 2. The Comparison between ISI, ESS, and BDI Scores in Different Shift Schedules**

	Fixed-day	Fixed-night	Swing	Standby	P value
ISI	9.7±5.5	15.5±10.2	10.5±5.7	10.2±5	0.14
ESS	6.9±4.1	9.3±4.4	7.1±4.3	7.7±4.8	0.57
BDI	9.5±8.6	7.8±7.6	10.1±10	10.1±7.4	0.93

All values are presented as mean ± SD. ISI: insomnia severity index; ESS: Epworth sleepiness scale; BDI: Beck depression inventory.

**Table 3. The Comparison between ISI, ESS, and BDI Scores of the Study Participants in Terms of SWD**

	SWD (+) Mean	SWD (-) Mean	P value	Mean difference	df	T test value
ISI	14.95	8.39	<0.001	6.555	190	8.196
ESS	9.18	6.38	<0.001	2.798	190	4.305
BDI	15.88	7.32	<0.001	8.559	187	6.383

ISI: insomnia severity index; ESS: Epworth sleepiness scale, BDI: Beck depression inventory; SWD: Shift work disorder

**Table 4. Regression for SWD Determinants after Adjusting for Age and BMI**

variables	B	P value	EXP(B)	95% CI for EXP(B)
ISI	-0.25	<0.0001	0.77	0.71 to 0.84
ESS	-0.15	<0.0001	0.85	0.79 to 0.92
BDI-II	-0.10	<0.0001	0.90	0.86 to 0.93

ISI: insomnia severity index; ESS: Epworth sleepiness scale, BDI: Beck depression inventory, BMI: Body Mass Index

### Discussion

Findings from the present study illustrated that workers who suffer from SWD had higher ISI, ESS, and BDI scores. Current results showed that workers with the SWD had more severe insomnia, daytime sleepiness, and depressive mood. Previous studies also support our results in terms of increased insomnia (21, 22, 23) and daytime sleepiness (23) in workers with SWD. In addition, several studies showed the higher rate of depression symptoms in workers with SWD in different workplaces (24, 25, 26). Depression and insomnia are more prevalent among elderlies and obese individuals. According to the confounder effect of age and BMI on studied outcomes of this research (depression and insomnia), regression analysis was performed. Furthermore, job satisfaction was significantly higher among those without SWD, which is supported by other studies among nurses (27) and other health care workers (28).

In the current study, the total prevalence of SWD in our participants was (29.7%), which is similar to the previous study conducted by Waage S et al among oil workers that showed 23.3% of the total participants suffered from SWD (29). More than half of the fixed-night shift workers reported SWD, which is more than rates reported by previous studies (5, 24). Di Milia L et al reported that 32.1% of the night workers in general community suffer from SWD (30) and Drake CL et al also showed that 32.1% of the night shift workers in public have SWD (5). Higher SWD in comparison to the general community may be due to more difficult work condition of oilrig workers. All of our participants were men, which might also increase the SWD prevalence. Flo E et al showed men report nearly 2 times the rate of SWD than women (23).

Insomnia and depression were significantly higher in workers with a high demand for increasing rest time during the work-time and lower job satisfaction. Similar

to our results, previous studies also showed the negative relationship between job satisfaction and depressed mood (31, 32).

Meanwhile, SWD, insomnia, daytime sleepiness, and depression were not significantly different among different shift work schedules, which could be due to the limited sample size of this study. In line with this study, Vallières A et al showed that insomnia severity is similar in the night and rotating shift workers, and suggested that sleep time is strongly related to insomnia rather than different shift work schedules (33). Furthermore, the quick return to work (less than 11 hours off work between work shifts) is also suggested as an important factor for insomnia than night working (34). However, contrary to our results, previous studies showed that working in night shift increases daytime sleepiness (35, 36) and depression (37).

### Limitation

There were several limitations in the present study, including the male gender of all the participants, which can have an adverse effect on the results. All participants were shift worker and there were not office workers as the control group. So multicentric studies are recommended. In addition, all data in the current study were collected by self-reported questionnaires; therefore, it is important to consider recall bias. Third, dishonest reporting of symptoms in the occupational settings due to fear of its consequences and impact on working condition. Furthermore, a cross-sectional study is not suitable for concluding about causal relationships. At last, there was a lack of objective data, including polysomnography in the present study.

We recommend choosing a larger population and objective data for future studies. In addition, the management of screened patients and confirming the disorder by objective diagnostic tools, such as polysomnography, is of importance.

## Conclusion

SWD is considered as a serious health-related issue in the Persian Gulf oilrig shift workers. Insomnia, daytime sleepiness, and depression are associated with SWD. Accordingly, the findings warrant consequent medical evaluation of oil rig shift workers for aforementioned conditions.

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## Conflict of Interest

Authors declare no conflict of interest.

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