

## A Comparative Study of Mental Health and Sleep Problems in Shift Workers and Day Workers of One Gas Refinery in Iran

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### Abstract

**Background and Objective:** Night work causes disorder in the sleep-wake cycle followed by physiological and psychological consequences. This study aimed to investigate the effects of shift work on mental health and sleep problems among workers of one gas refinery in Iran.

**Materials and Methods:** This study was a descriptive, type ex post facto study. The sample consisted of shift and day workers of one gas refinery in Iran. A total of 255 workers were selected from the refinery by purposive sampling (126 day workers and 125 shift workers) and were evaluated using scl-90-R, Pittsburgh Sleep Quality Index, and demographic questionnaires. Data were analyzed through SPSS using t-test, one-way ANOVA, and regression methods.

**Results:** The findings suggested that there is no significant difference between shift workers and day workers in terms of mental health ( $M = 0.38$  in day workers vs.  $M = 0.40$  in day workers). There was a non-significant difference between shift workers and day workers in terms of sleep problems ( $M = 5.43$  in day workers vs.  $M = 6.33$  in shift workers); however, the differences between two groups in sleep latency and sleep efficacy were significant. The findings also suggested that marital status and place of residence of workers have no significant effect on sleep problems or their mental health.

**Conclusion:** It seems that although sleep problems are more common in shift workers than in day workers, there were no significant psychological problems between these groups in our sample.

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**Keywords:** Mental health; Sleep; Shift work schedule

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### Introduction

Governments and businesses whose permanent activity is vital are forced to regulate shift work such as morning, afternoon, and night shifts, or 12-hour shifts. In America, shift work refers to a work time from 7 to 21 hours per day (1). Accord-

ing to Koji (1), shift work is a work starting before 6 A.M. or after 6 P.M. Night work causes disorder in the sleep-wake cycle followed by physiological and psychological consequences. Night workers are not able to sleep during the day due to daylight and daily tasks (2).

Gerber et al. showed that police officers on shift work reported more sleep problems (35.0% vs. 26.3%). Their results also showed that the number of accidents caused by insomnia was sig-

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nificantly higher among shift workers (2). Experts suggest that increasing the rest time between shifts may improve sleep quality, enhance self-perceived health, and reduce the risk of cardiovascular diseases (2, 3). Considering the fact that shift work can seriously harm physical and mental health of employees, examination of the employees of any specific industry would help develop proper programs to prevent any further damages caused by shift work. Although modern society requires work with several shifts, employees are exposed to high stress jobs, and there are a few studies in Iran on psychological health and sleep hygiene of shift workers. Research shows that nearly 82% of gas refinery workers complain of inadequate sleep due to a negative effect on cognitive performance, such as logical reasoning and working memory (4).

In another research, Drake et al. investigated the prevalence of sleep disorder caused by shift work among 2570 employees living in Detroit, United States, and showed a prevalence as high as 10%. They also showed that people who suffer from this disorder are at higher risk for health problems and behavioral disorders (5).

Ohayon et al. also divided psychiatric hospital staff into three groups of day workers: Morning, evening, and night shift workers and rotation shift workers. They showed that rotational group had more sleep problems compared with day workers. Shift workers had shorter sleep, but the difference of sleep duration between the shifts was not as specific and certain as rotational day group. A large number of rotational shift workers had greater sleep problems and shorter sleep while transferring to morning shift (3). One of the consequences of shift work is daytime sleepiness subjecting the workers to mistakes or accidents related to the work.

Sahraian et al. in a cross-sectional study among 128 residents of Shiraz University of Medical Sciences showed that there was a significant association between sleep deprivation and general health status of the residents. There was also a relationship between the numbers of working shifts in a week and general health status (based on GHQ questionnaire) (6). The study of mental health of workers in gas refining company of Tabriz showed that shift workers had higher mean in obsession, physicalizing, interpersonal sensitivity, hostility, and paranoid compared with day workers. The difference was statistical-

ly significant for obsession (7).

However, not all studies have demonstrated the difference between shift workers and non-shift workers. Lavie et al. indicated that there is a process of natural selection among shift workers, those who have difficulty in coping with shift work are transferred to day work (8). Among female hospital employees, Lajoie found no sufficient evidence for the association between sleep problems and metabolic syndrome due to rotating shifts (9). It seems that shift workers of gas industries expose to a higher risk of negative effects from sleep problems, but they have been less studied. Thus, the aim of this research was to study the psychological health effects of shift work and sleep hygiene among the staff of a refinery in Iran.

## Materials and Methods

This study was a descriptive type ex post facto study. The sample consisted of official shift workers and day workers of one gas refinery in Iran. The sample size was 226, but we added 30 additional participants to reduce the sampling error and missing data. Using purposive sampling, 255 employees of the refinery (126 day worker and 125 shift workers) completed the questionnaires. Shift workers were defined as workers who had two working durations such that they work at 6 A.M to 6 P.M. and the 2<sup>nd</sup> week at 6 P.M. to 6 A.M followed by 1 week resting. The inclusion criteria were as follows: (1) Being day workers or shift workers in at least 1 recent year without changing the work routine and (2) age between 20 to 60 years old. The exclusion criterion was abusing drugs and substances.

### Data collection tools

*Symptoms checklist (SCL-90)*: The initial form is created by Derogatis and Cleary (10). The Persian version has been adapted from the latest edition prepared by Derogatis and Cleary (10) in the United States of America. The test is consisted of 9 clinical sub-scales including physicalizing, obsessive-compulsive, interpersonal problems, depression, anxiety, aggression, phobias, paranoid thoughts, and psychosis. This scale has shown acceptable content validity and reliability in several studies in Iran. In a study conducted by Modabernia et al. in Iran, to evaluate the reliability and validity of the test, the reliability was more than 0.8 in all measures except aggression, phobia, and paranoid thoughts (11).

This test can be used as a good tool for screening patients with psychiatric problems and presumptive diagnosis. In this research, the global severity index (GSI) was used to evaluate the mental health of participants. GSI converted to T scores so that  $T > 63$  indicated the significant levels of mental problems. The SCL-90 software was used for interpreting of data.

#### *Pittsburgh Sleep Quality Index (PSQI)*

This is a self-reported questionnaire measuring sleep quality and sleep disturbances within the past month. 19 individual items measure 7 subscales: Subject's sleep quality, sleep latency, sleep duration, typical sleep efficiency, sleep disturbances, the use of sleeping medication, and daily inefficiencies. In a study by Buysse et al. (12), diagnostic sensitivity of 89.6% and specificity of 86.5% were achieved for the questionnaire. PSQI showed acceptable psychometric properties in examples of Iranian society (Cronbach's alpha of 0.79) and acceptable inductive correlation of 0.4 in 6 components of 7 components (13). A PSQI global score  $> 5$  indicates that a subject is having difficulties in at least two areas or moderate difficulties in more than three areas.

#### *Demographic questionnaire*

It was research-made and consisted of data on the type of shift work, education, age, marital status, place of residence, work experience, and history of referring to a psychiatrist. Researchers distributed the questionnaires among those who were willing to participate in the project and all participants completed consent form.

Native residents consisted of staff lived in area of the refinery and were native. Non-native residents consisted of staff who were originally from other cities but lived in area of the refinery. Non-residents consisted of staff who lives in other cities and flight to their work and lives in pensions during the work period.

At last, 255 completed questionnaires were analyzed using SPSS software (SPSS, Inc., Chicago, IL, USA). For analyzing data, t-test, ANOVA, and regression were used.

## **Results**

The mean (SD) age of the participants was 34.02 (6.09) years. The mean job experience in participants was 84.75 (50.2) months (Table 1).

**Table 1.** The mean and standard deviation of age and job experience of participants

Demographic variables	Mean (SD)	Minimum	Maximum
Age (year)	34.02 (6.09)	21	57
Job experience (month)	84.75 (50.2)	12	371

SD: Standard deviation

Most of participants had Bachelor of Science (BSc) degree (68.6%) and 15.7% of them had Master of Science (MSc) and Philosophy Doctor (PhD) degrees. 15.7% of the participants were single. 12.5% of the participants had a physical illness and used a medication constantly (Table 2). The number of day workers and shift workers were approximately equal (126 day workers vs. 125 shift workers). 62.7% of the participants were employed in a categorical official contract and 35.6% of them were under the temporary contractual employment. Most of the participants did not dwell in area of the refinery (40%) and lived in dormitory in working period, 29.8% of them were native and resided in the city near the refinery, and 28.6% lived in a city near the refinery, but they were not native (Table 2).

**Table 2.** Frequency and percentage of marital status, educational status, working status, type of contract, status of residence, and physical health status

Variable	Frequency (%)
Marital status	
Single	40 (15.7)
Married	211 (82.7)
No reply	4 (1.6)
Education status	
Under BS	38 (14.9)
BSc	175 (68.6)
MSc and PhD	40 (15.7)
No reply	2 (0.8)
Working status	
Day workers	126 (49.4)
Shift workers	125 (49)
No reply	4 (1.6)
Type of contract	
Official	160 (62.7)
Contractual hiring	91 (35.6)
No reply	4 (1.6)
Habitant status	
Native residents	76 (29.8)
Non-native residents	73 (28.6)
Non-residents	102 (40)
No reply	4 (1.6)
Physical health	
Sick	32 (12.5)
Healthy	220 (86.3)

**Table 3.** T-test to compare the mean values of the two groups in psychological health and sleep problems and subscales of sleep quality index

Variable	Group	Mean (SD)	t	df	P-value
Psychological health	Day workers	0.38 (0.40)	0.39	249	0.69
	Shift workers	0.40 (0.36)			
Sleep problems	Day workers	5.43 (3.34)	1.89	221	0.06
	Shift workers	6.33 (3.75)			
Duration of sleep	Day workers	1.32 (0.91)	0.16	225.19	0.86
	Shift workers	1.34 (1.12)			
Sleep disturbances	Day workers	0.96 (0.54)	0.84	246	0.4
	Shift workers	1.02 (0.51)			
Sleep latency	Day workers	0.73 (0.86)	2.32	233	0.02
	Shift workers	1 (0.84)			
Daytime dysfunction due to sleepiness	Day workers	0.09 (0.78)	1.51	248	1.13
	Shift workers	1 (0.87)			
Sleep efficacy	Day workers	0.45 (0.79)	2.59	205.44	0.01
	Shift workers	0.77 (1.07)			
Overall sleep quality	Day workers	0.99 (0.99)	1.89	246.29	0.05
	Shift workers	1.16 (1.16)			
Medication-induced sleep	Day workers	0.14 (0.53)	0.08	248	0.93
	Shift workers	0.13 (0.51)			

Table 3 summarizes the results of independent t-test to compare mean values of psychological health and sleep problems of the two groups of shift workers and day workers. The psychological health was derived from GSI extracted from SCL-90. It was shown that the value of t for psychological health was 0.39 with significance level 0.69, indicating that this difference was not statistically significant ( $P > 0.05$ ). This table also shows that there is no significant difference between two groups in terms of sleep problems ( $t = 1.89$ ,  $P = 0.06$ ). This table also shows the results of an independent t-test to compare the differences of sleep problems subscales among shift workers and day workers. Independent t-test in sleep latency subscale was 2.32 with significance level of 0.02, indicating that there is a significant difference between the mean values of two groups with  $\alpha = 0.05$ . According to the mean values, it is shown that the problem was more common in shift workers than day workers. Furthermore, independent t-test in overall sleep quality subscale was 2.59 with significance level of 0.01, indicating that there was a significant difference between mean values of the two groups with  $\alpha = 0.05$ .

Table 4 summarizes the pairwise mean

differences of the groups. It is shown that only the sleep problems of native and non-native residents are significant (Table 5). According to observed mean value, sleep problems were worse in non-native residents than in native residents ( $P = 0.02$ ).

Table 6 summarizes the linear regression test to measure the impact of demographic variables on sleep problems. Accordingly, age, marital status, and place of residence had no significant effect on sleep problems. Only the variable of employment status (day working or shift working) had a very weak influence on sleep problems ( $P = 0.02$ ,  $B = 0.16$ ).

## Discussion

This study indicated that there was no significant difference between day workers and shift workers of the refinery in terms of sleep problems and psychological health. Although, shift workers reported more problems in sleep duration and sleep quality compared with day workers. Shift working is abundant among full-time and part-time employees around the world. Shift work has been reported in about 15% of the workforce of many countries in Europe, North and South America, and Australia.

**Table 4.** One-way ANOVA test to compare the mean values of sleep problems between two groups in terms of residence

Source of variance	Mean square	df	Total square	F	P-value
Between groups	92.58	2	46.29	3.78	0.02
Within groups	2692.23	220	12.23		
Total	2784.81	222	-		

**Table 5.** Tukey's range test for pairwise comparison in the means

Type of residence(I)	Type of residence (J)	Mean	P-value
Native resident	Non-native resident	-6.57	0.02
	Non resident	4.92	0.13
Non-native resident	Native resident	6.57	0.02
	Non resident	6	0.56
Non resident	Native resident	-4.92	0.13
	Non-native resident	6	0.56

Shift work is common in many jobs. Health and safety of others may be at risk due to damages to performance and consciousness of the staff. For example, in America, half of the workers are support services (police, fire department personnel, nurses, etc.) and half are shift transport workers (14).

**Table 6.** Linear regression test to measure the impact of demographic characteristics on sleep problems

Characteristics	R	R <sup>2</sup>	Beta	t	P-value
Age	0.01	0.001	0.01	0.24	0.80
Marital status	0.05	0.003	0.05	0.71	0.47
Type of residence	0.11	0.010	0.11	0.15	0.12
Job status	0.19	0.030	0.16	2.25	0.02

Scientific evidence shows that adequate sleep is one of the essential needs of life similar to the need for food and water and it is essential for survival, health, and safety (15). Many studies have shown that shift work and long hours of work that affect regular sleep-wake rhythm lead to the risk of reduced job function, obesity, injuries, chronic diseases, and increased errors caused by fatigue (15). The present study showed that there was no significant difference between day workers and shift workers of the refinery in terms of sleep problems and psychological health. However, shift workers reported more problems in sleep duration and sleep quality compared to day workers. As noted, not all studies on the impact of shift work on physical and psychological health are aligned. Individual differences affect how to tolerate shift work and its impact on sleep and other health parameters. Gender, age, personality traits such as daily type (e.g., prefer to sleep early or late, and waking up), sleep cycle style, flexibility and ability to fall asleep or working at unusual times, toughness, and resistance to environmental stressors affect the tolerance of shift work (16). Most workers use napping before the start of their shifts as a strategy to increase awareness. It is said that a 40-minute nap in the middle of a 12-hour night shift will improve reaction, awareness, and

fatigue time. Furthermore, using caffeine before nap during sleep deprivation reduces the negative effects of sleep inertia. Getting enough sleep after long hours of sleep deprivation can improve subsequent physiological awareness and reduce the negative effects of shift work (14). Flo et al. noted that although the prevalence of shift work-related sleep disorder (shift work sleep disorder) was high among nurses (37.6%), it should be highlighted that 60% of nurses reported no sleep problems or drowsiness in relation to their work schedule (17). It is shown that some personality variables seem to predict insomnia among shift workers such that neuroticism was positively predictive of insomnia, whereas morningness was negatively related to insomnia. Furthermore, age had a negative relation to insomnia (18).

Akerstedt (19) reported that surprisingly a very fast adaptation of sleep (3-4 days) and relatively good sleep quality were observed in a group of employees of gas facilities. It is said that lack of light during day and lack of competition in social activities help fast and high adaptation. Furthermore, this study indicated that non-native residents reported more sleep problems compared with native ones. This can be caused by stress related to staying away from family and dormitory life. In general, it seems that despite some problems in the sleep in the sample of shift workers, there is a favorable adjustment to prevent psychological problems. Therefore, it is recommended to use systematic solutions such as medication, part-time employment, limiting the number of night shifts, and creating more flexible shifts to reduce sleep problems caused by shift work. One of the limitations of this study was the limited sample size. Moreover, the relationship between psychological health and shift work can be affected by other variables such as work experience, personality traits, marital status, organizational rank, and place of residence. This study attempted to include and investigate the effect of abovementioned variables as moderating variables. Furthermore, due to specific conditions of work, the results should be generalized with caution.

## Conclusion

This research showed that shift workers had more sleep problems, especially in latency and efficacy of sleep than day workers, although the mental health status in two groups was equal. The

findings also suggest that marital status had no significant effect on sleep problems or mental health in the participants, but the workers who immigrated to the city near the refinery but were not native had more problems in sleep. It seems that there are some adaptive mechanisms for workers to reduce the negative effects of shift working on their mental health that is needed to determine in other research.

### Conflict of Interests

Authors have no conflict of interests.

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