

Original Article

Influence of 24-Hours Shift Work System on Occupational Stress among Iranian Firefighters

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Abstract

Introduction: Firefighters are exposed to variety of stressors. Job related factors and shift-work system are the main stressors among Iranian firefighters. It seems necessary to study these related factors. Therefore, the present study aimed to find out what dimensions of job stress are associated with 24-hour shift-work schedule of firefighters.

Materials and Methods: After studying the validity and reliability of Persian version of NIOSH Generic Job Stress Questionnaire, 228 firefighters completed it, together with the validated version of the Survey of Shift-worker (SOS) questionnaire. The Spearman, Chi 2, Mann-Whitney and ANOVA statistical analysis were conducted through SPSS 18.

Results: Results showed that some undesirable effects of Shiftwork in more than 60% of firefighters are medium to high. There was a significant relationship between variables of shiftwork (sleep disorders, the undesirable effects of shiftwork) and the variables of job stress (ambiguity in job future, workload, physical environment, job control, employment opportunities, non-work activities, social support from bosses, spouse, friends, relatives, subjective demands, role incompatibility, role ambiguity and job satisfaction).

Conclusion: The present study shows that adverse effects of 24-Hour Shiftwork and occupational stress largely interact with each other. Therefore, it could be concluded that job stress could be moderated or reduced and job satisfaction could concurrently be increased through focusing on the roots of occupational stress from the perspective of shiftwork systems.

Keywords: Firefighter, Job satisfaction, NIOSH Generic Job Stress Questionnaire (NGJSQ), Occupational Stress, Survey of Shift workers' questionnaire (SOS)

1. Introduction

Firefighting is a stressful job and those who work at this position are highly exposed to different job stressors[1] and as a result, suffer from physical and psychological problems[2]. Firefighters are prone to anxiety[1]. Some studies have

reported the prevalence of PTSD, indicating that this problem in firefighters is far higher than community population [3-6]. Alipour's study demonstrated that firefighters are also susceptible to experiencing problems even more than the mentioned ones [7]. According to previous studies, job stress

affects about 30% of the workforce in developed countries[8] and this has made firefighting job a stressful one in those countries [8, 9]. Surveys indicate that the highest rate of illness and mortality in firemen is directly or indirectly correlated with their stressful job nature. Therefore, in US this job is in fifth rank in terms of job mortality because it is a stressful and dangerous one [1]. According to previous studies conducted in Iran, job stress is also a major problem within country [10].

Job stress is one of the most serious occupational dangers in modern firefighting services which firemen encounter with, and it is important because stress may have negative effects on health, job performance, decision-making, and the family life. It could create some conditions that disturb individual welfare and mental health[11]. Since firemen directly deal with saving individuals in very difficult circumstances and need full consciousness and quick and appropriate decision-making are requirements of this job, and since they commonly save the lives of citizens, improvements of their physical, behavioral, and mental conditions are of critical importance [12]. Since 1999, US National Institute for Occupational Safety & Health (NIOSH) has presented a definition for job stress. According to this definition, job stress occurs when there is not coordination between job demands and the individual abilities and capabilities [13]. In defining shiftwork, it could be said that in general, any work that regularly and certainly is performed out of time window of daily work is regarded as a shiftwork [14]. Shiftwork has short-term (acute) and long-term (chronic) effects. From the former, effect on system of circadian and sleep-wake cycle, the undesirable effect on the individual, family and social lives, and from the latter, gastrointestinal and cardiovascular problems and risk of neurological diseases could be mentioned[15]. A Survey by Tucker et al. indicated that resting times had lower

impact on health of employees compared with the other shift factors (like working hour/time) [16]. In a study conducted by Esquirol et.al in 2009, it was concluded that shiftwork increased job stress and metabolic and gastrointestinal disorders[17]. Coffey et.al studied various shiftwork systems among registered nurses and concluded that, rotating shiftwork nurses followed by afternoon shift schedule have the highest occupational stress.[18]. Gerber et.al indicated that shiftwork schedule has an undesirable effect on stress in police officers and stress could be lowered if the shift workers have flexible times [19]. Hoffman in her study found that stress level does not differ between 8 and 12 Hours shiftwork nurses [20]. A study conducted by Garbarino indicated that shiftwork caused disorders in social and family lives [21]. Although some studies were performed about the dangers of firemen's job in developed countries [22], this issue has not been well covered in Iran and to the best of our knowledge, no new report was found specifically about the relationship between effects of shiftwork and job stress variables; therefore this study was aimed to determine the relationship among the effects of 24-hour shifts on occupational stress in firefighters.

2. Materials and Methods

2.1 Study Setting and Research Design

A Cross-sectional study was conducted in 2014, in which the results of work undertaken for a project on job stress factors in the firefighters with 24-hour shift-work system is presented in capital of Iran (Tehran). This work was approved by ethical committee of Tehran university of medical sciences under 240/3412 ethical code.

2.2 Sample Size and Sampling Methods

The present study was conducted on 228 firefighters in Tehran. Cluster sampling was

performed in five operating regions of Tehran and 8 operating stations were selected randomly from the 49 existing stations; the firefighters in the stations were all asked to fill the questionnaires.

2.3 Questionnaire and Data Collection

The selected factors from Niosh Generic Job Stress Questionnaire contains 140 questions about variables including: ambiguity in job future, the personal feelings, quantity of workload, changes in workload, responsibility for the people, low use of skill, physical environment, control scale, employment opportunities, non-work activities, social support (bosses), social support (the other employees), social support (spouse, friends, relatives), subjective demands, inter-group conflicts, intra-group conflicts, role incompatibility, role ambiguity, job satisfaction. Validity and reliability of Persian version of Niosh Generic Job Stress Questionnaire was first examined and then confirmed by the researcher. Results indicated that Cronbach's alpha coefficient for Persian version of NIOSH was 0.70 – 0.96 and intraclass correlation coefficients was found to be 0.45-0.94 by test-retest [23]. Furthermore, various surveys have been performed in different communities with different languages (English, Chinese, and Japanese) to find validity and reliability of this questionnaire and results have been similar to those of Persian version of NGJSQ[24-26].

Another questionnaire used in this research was Survey of Shift Workers (SOS) questionnaire developed by research group in MRC/ESRC Social and Applied Psychology Unit in England and is one of the most valid and complete questionnaires in the field of study of problems associated with shiftwork. The selected factors from this questionnaire in the present research include questions about: demographic variables: (age, work experience, education level, marital status, number of children, and second job), sleep disorders,

undesirable effects of shiftwork on the individual life: (rest, study, exercise, going to bank, etc.), and undesirable effects of shiftwork on family life: (lack of adequate opportunity to do home affairs, care for children and parents, participate in family reunions, etc.)[27]. Validity and reliability of Persian version of the questionnaire has been previously evaluated by Choubineh et al. and its reliability has been reported over 0.70 by Cronbach's alpha coefficient[28-30]. An expression was included in the questionnaires that illustrated the objectives of evaluation and demanded voluntary participation. Content with completing and returning the questionnaires was regarded as satisfaction with participation.

2.4 Statistical analysis

The data were analyzed using SPSS ver. 18 (SPSS Inc., Chicago, Illinois, United States of America). Descriptive statistics (frequency and percentage) and deductive statistics (Spearman's correlation test and Chi 2 test) were employed. Moreover, Mann-Whitney and Kruskal-Wallis and variance analysis tests were used to compare the averages. Due to the variables collected from firefighters and taking into account the confounding effect of these variables on the dependent variable (occupational stress), confounders were controlled by multiple logistic regression.

2.5 Research Ethics:

The method protocol of this study was approved by ethics committee at Tehran University of Medical Sciences; participants were ensured about the confidentiality of their information.

3. Results

The obtained sample consisted of 228 people from among firefighting staff, all of whom were male and within age range of 20-52. Among the participants, 30.3% were single and 69.7% were married. Education levels included 2.2% under diploma, 61.8% diploma, 20.2% associate diploma, 14.5%

BA, and 1.3% MA. In this study, 35.5% had one child, 7.9% had two children, and 2.2% had three children. In terms of age, 7.5% were under 25, 87.7% were between 26 and 40, and 4.8% were above 40. With respect to work experience in firefighting, 29% had 5 years, 56.2% (128 people) had 5-10 years, 8.3% had between 11-15 years, and 6.6% had over 15 years of work experience. Moreover, 27.6% of firemen had second job while 72.4% did not possess a second job. In terms of sleep disorder, 14.9% had low,

39.9% medium, and 45.2% high sleep disorders. The undesirable effects of shiftwork on the individual life have been reported low in 34.2% of firemen, medium in 34.2% of them, and high in 31.6% of them. Such effects on family life have been reported low in 36.9% of firefighters, medium in 36.4% of them, and high in 26.7% of them. Effects on social life have been reported low in 36.4% of firemen, medium in 39% of them, and high in 24.6% of them.

Table 1. Descriptive results according to Survey of Shift-worker questionnaire

Demographic Factor	Categories	N (%)
Age	20-29	94(41.2%)
	30-39	119(51.2%)
	40-49	12(5.3%)
	>49	3(1.3%)
Education Level	Under Diploma	5(2.2%)
	Diploma	141(61.8%)
	Associate Diploma	46(20.2%)
	B.A	33(14.5%)
	M.A	3(1.3%)
Work experience (Years)	<5	66(28.9%)
	5-10	128(56.2%)
	11-15	19(8.3%)
	> 15	15(6.6%)
Marital status	Single	69(30.3%)
	Married	159(69.7%)
Sleep disorder¹	Low	34(14.9%)
	Medium	91(39.9%)
	High	103(45.2%)
Number of Children	No child	81(35.5%)
	One child	23(10.1%)
	More than one	23(10.1%)
The undesirable effect ²	Low	78(34.2%)
	Medium	78(34.2%)
	High	72(31.6%)
The undesirable effect ³	Low	84(36.9%)
	Medium	83(36.4%)
	High	61(26.7%)
The undesirable effect ⁴	Low	83(36.4%)
	Medium	89(39%)
	High	56(24.6%)

1. (sleeping hours per day, insomnia, use of hypnotic drugs)

2. The undesirable effects of shiftwork on the individual life: (resting, study, exercise, going to barbershop, going to bank)

3. The undesirable effects of shiftwork on the family life: (lack of adequate opportunities to do home affairs, care for children, parents, and participation in family unions)

4. The undesirable effects of shiftwork on the social life

Results of Pearson Correlation Test are presented in Table 2. The mean difference of shiftwork and job stress variables is significant and as follows:

There were statistically significant positive relationships between ambiguity of job future and the undesirable effects of shiftwork on the individual life ($P=0.003$, $r=0.198$), on family life ($P=0.04$, $r=0.145$), and on social life ($P=0.036$, $r=0.133$). The relationships between workload and sleep disorder is reported as ($P=0.041$, $r=0.136$), between workload and the undesirable effects of shiftwork on the individual life ($P=0.042$, $r=0.135$), and on family life ($P=0.043$, $r=0.134$), between physical environment and the undesirable effects of shiftwork on the individual life ($P=0.0009$, $r=0.232$), on family life ($P=0.0009$, $r=0.257$), and on social life ($P=0.043$, $r=0.134$), between non-work activities and the undesirable effects of shiftwork on family life ($P=0.020$, $r=0.154$), on social life ($P=0.022$, $r=0.152$), between subjective demands and sleep disorder ($P=0.011$, $r=0.169$), between intra-group conflicts and the undesirable effects of shiftwork on the individual life ($P=0.036$, $r=0.140$), between role ambiguity and sleep disorder ($P=0.037$, $r=0.139$), between role incompatibility and the undesirable effects of shiftwork on family life ($P=0.038$, $r=0.142$), and on social life ($P=0.039$, $r=0.137$). The results obtained from statistical analyses indicated that increasing ambiguity in job future can increase the undesirable effects of shiftwork on the individual, family, and social lives of firemen. The undesirable effects of shiftwork on the individual, family, and social lives of firefighters increased with worsened physical environment. The undesirable effects of shiftwork on the family and social lives of firemen increased with increase of non-work activities. The

undesirable effects of shiftwork on the individual, family, and social lives of firemen increased with the increase of workload quantity level. Sleep disorders in firefighters increased with the increase in subjective demands. Sleep disorder increased with increasing role ambiguity. The undesirable effects of shiftwork on the individual, family, and social lives of firemen increased with the increase of the intra-group conflicts. There was statistically significant negative relationship between control scale and the undesirable effects of shiftwork on the family life ($P=0.036$, $r=-0.140$) and on social life ($P=0.029$, $r=-0.145$), between employment opportunities and the undesirable effects of shiftwork on the family life ($P=0.007$, $r=-0.178$) and on the social life ($P=0.018$, $r=-0.156$), between social support (bosses) and the undesirable effects of shiftwork on the individual life ($P=0.000$, $r=-0.231$), on the family life ($P=0.020$, $r=-0.153$), and on the social life ($P=0.036$, $r=-0.140$), between social life (spouse, friends, relatives) and the undesirable effects of shiftwork on the family life ($P=0.035$, $r=-0.139$), on social life ($P=0.004$, $r=-0.191$), and between job satisfaction and the undesirable effects of shiftwork on the social life ($P=0.021$, $r=-0.152$). The results obtained from the statistical analysis indicated the undesirable effects of shiftwork on the family and social lives of firemen. The undesirable effects of shiftwork on the family and social lives in firemen increased with decrease in social support (spouse, friends, relatives) for firefighters. The undesirable effects of shiftwork on the individual, family, and social lives of firefighters increased with decrease of social support (bosses) for firefighters. Also, the undesirable effects of shiftwork on the social lives of firemen increased with decrease in job satisfaction.

Table 2. Review of correlation between shiftwork factors and job stress factors by using Pearson correlation test

Job Stress factors	Shift-work factors			
	Sleep disorder	Individual life	Family life	Social Life
Ambiguity in job future	0.083	0.198b	0.145c	0.133c
How do you feel about yourself?	- 0.024	- 0.047	- 0.056	-0.004
Workload quantity	0.136 c	0.135c	0.134c	- 0.020
Workload changes	0.103	- 0.079	- 0.016	- 0.015
Responsibility for people	0.008	0.061	- 0.021	- 0.092
Low use of skill	- 0.036	0.058	0.028	- 0.050
Physical environment	- 0.066	0.232a	0.257a	- 0.134c
Control scale	0.029	- 0.049	-0.140c	- 0.145c
Employment opportunities	0.046	- 0.062	-0.178b	- 0.156c
Non-work activities	0.082	0.055	0.154c	0.152c
Social support (bosses)	0.023	- 0.231a	-0.153c	- 0.140c
Social support (other employees)	- 0.031	0.077	0.039	0.056
Social support (spouse, friends, ...)	0.039	0.051	-0.139c	- 0.191b
Subjective demands	0.169c	- 0.061	0.009	0.036
Intergroup conflicts	- 0.060	0.100	0.031	- 0.062
Intra-group conflicts	- 0.073	0.140 c	0.089	0.006
Role incompatibility	0.043	0.010	0.142 c	0.137c
Role ambiguity	0.139c	- 0.095	- 0.098	- 0.090
Job satisfaction	- 0.069	- 0.036	- 0.014	- 0.152c

P-Value: a ≤ 0.001 , b ≤ 0.01 , c ≤ 0.05

Table 3 illustrates the analysis of backward multiple regressions as to evaluate correlation of shiftwork and job stress variables. All of the factors with significant correlation coefficients were included in this model and its results are as follows:

The statistically significant relationship has been retained between ambiguity in job future, and the undesirable effects of shiftwork on the individual life ($P=0.003$), and the statistical relationship between ambiguity of job future and the undesirable effects of shiftwork on the family and social lives has been removed.

The statistically significant relationship between workload and sleep disorder ($P=0.041$), and between workload and the undesirable effects of shiftwork on the individual life ($P=0.042$) have been retained, and the statistical relationship between workload and the undesirable effects of shiftwork on the family life has been removed.

The statistically significant relationship between physical environment and the

undesirable effects of shiftwork on the family life ($P=0.0009$) has been retained, and statistical relationships between physical environment and the undesirable effects of shiftwork on the family and social lives have been removed. The statistically significant relationship between control scale and the undesirable effects of shiftwork on the social life ($P=0.029$) has been retained, and statistical relationship between control scale and the undesirable effects of shiftwork on the family life has been removed. The statistically significant relationship between employment opportunities and the undesirable effects of shiftwork on the family life ($P=0.007$) has been retained, and statistical relationship between employment opportunities and the undesirable effects of shiftwork on the social life has been removed. The statistically significant relationship between non-work activities and the undesirable effects of shiftwork on the family life ($P=0.020$) has been retained, and statistical relationship between non-work activities

and the undesirable effects of shiftwork on the social life has been removed. The statistically significant relationship between social support (bosses) and the undesirable effects of shiftwork on the individual life ($P=0.0009$) has been retained, and statistical relationships between social support (bosses) and the undesirable effects of shiftwork on the family and social lives have been removed. The statistically significant relationship between social support (spouse, friends, relatives) and the undesirable effects of shiftwork on the social life ($P=0.004$) has been retained; however, statistical relationship between social support (spouse, friends, relatives) and the undesirable effects of shiftwork on

the family life has been removed. Also, the statistically significant relationship between the role incompatibility and the undesirable effects of shiftwork on the family life ($P=0.015$) has been retained; however, statistical relationship between the role incompatibility and the undesirable effects of shiftwork on the social life has been removed. Also, the statistically significant relationship between subjective demands and sleep disorder ($P=0.011$), between role ambiguity and sleep disorder ($P=0.037$), and between job satisfaction and the undesirable effects of shiftwork on the social life have been retained.

Table 3. Results of multiple regression analysis of shiftwork factors and job stress factors

Job Stress factors	Shift-work factors							
	Sleep disorder		Individual life		Family life		Social life	
	P-value	t	P-value	t	P-value	t	P-value	t
Ambiguity in job future	-	-	3.04	0.003	-	-	-	-
How do you feel about yourself?	-	-	-	-	-	-	-	-
Workload quantity	2.06	0.041	2.06	0.042	-	-	-	-
Workload changes	-	-	-	-	-	-	-	-
Responsibility for people	-	-	-	-	-	-	-	-
Low use of skill	-	-	-	-	-	-	-	-
Physical environment	-	-	-	-	3.99	0.0009	-	-
Control scale	-	-	-	-	-	-	-2.20	0.029
Employment opportunities	-	-	-	-	-2.71	0.007	-	-
Non-work activities	-	-	-	-	2.33	0.020	-	-
Social support (bosses)	-	-	3.56	0.0009	-	-	-	-
Social support (other employees)	-	-	-	-	-	-	-	-
Social support (spouse, friends, ...)	-	-	-	-	-	-	2.92	0.004
Subjective demands	2.57	0.011	-	-	-	-	-	-
Intergroup conflicts	-	-	-	-	-	-	-	-
Intra-group conflicts	-	-	-	-	2.43	-	-	-
Role incompatibility	-	-	-	-	-	0.015	-	-
Role ambiguity	2.11	0.037	-	-	-	-	-	-
Job satisfaction	-	-	-	-	-	-	-2.31	0.021

4. Discussion

Results of current study indicated that the undesirable effects of shiftwork on social life increased with decrease in job satisfaction. As Choobineh et al.[29] and kazeronian et al.[23] concluded in their studies, prevalence of the undesirable effects of shiftwork on the social life among shift working surgical technologists with high job satisfactions were lower and the

same results presented in another studies[31, 32]. According to the obtained results, some job stress factors have direct relationships with shiftwork factors so that the undesirable effects of shiftwork on the individual, family, social lives of firemen increase with increase of ambiguity of job future. The undesirable effects of shiftwork on the individual, family, and social lives increase with worsened physical

environment conditions. The undesirable effects of shiftwork on the family and social lives of firefighters increase with increasing non-work activities. Sleep disorders in firemen increase with increasing subjective demands. Sleep disorder increases with increasing role ambiguity and finally the undesirable effects of shiftwork on the individual, family, and social lives of firefighters increase with increasing intra-group conflicts. In a study conducted by Golubic et al.[33], they concluded that shiftwork increased job stress and various disorders in the individuals, and also decreased job satisfaction[33]. Moreover, in a study conducted by Garbarino, it was concluded that shiftwork caused disorders in the social and family lives and had negative effects on performance and social relations[21]. In his study, Andre Mac vicar [34] concluded that there was a significant relationship between shiftwork and job stress[34]. Lotfizadeh et al. concluded that there was a powerful statistical relationship between social support and quality of life [35]. In a study, Mohammadi et al. concluded that there were significant relationships between job stress and incompatibility with job conditions, characteristics of working environment, organizational atmosphere, job characteristics, and shiftwork [12]. In a study, Lotfizadeh et al. concluded that prevalence of stress among shift workers was more than that among the other workers. From total six causes of stress in production sector workers, only relations with colleagues had not significant relationship with stress, and the rest of causes including job conditions, problems of children and family, economic status and working environment conditions had significant relationships with stress[36]. In a study conducted by Tarshiz et al.[36], results indicated that there was a statistically significant relationship between inadequate sleep and job stress level[36]. The main limitation of this study is its cross-sectional design; therefore, further

studies with more robust protocols are recommended.

5. Conclusion

In general, it could be concluded that ambiguity in job future, quantity of workload, unsuitable physical environment, low job control, limited employment opportunities, excessive non-work activities, low social support (bosses) and (spouse, friends, and relatives), high subjective demands, increase in role incompatibility and role ambiguity increased sleep disorders and the undesirable effects of shiftwork on the individual, family, and social lives, and decreased their job satisfactions. Therefore, by focusing on causes of job stress from aspects of the undesirable effects of shiftwork and job satisfaction, and also by adopting management and strategic programs to reduce such effects, level of job stress in firefighters could be moderated and/or reduced and also their job satisfaction level could be increased and as a result efficiency and productivity of the organization would be enhanced. Moreover, with respect to several problems associated with firefighting job and its high sensitivity, the organization must prioritize some interventions to improve working environment and work condition to increase social supports, to reduce job incompatibilities and ambiguities, to remove ambiguities associated with job future, to establish optimal interpersonal and intergroup relationships, to provide optimal welfare facilities, to provide optimal public and specific facilities, and to develop the appropriate shiftwork programs in order to minimize job stress for firefighters.

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Conflict of interest

The authors declare no conflict of interest.

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