

## Effects of Shift Work on Health and Satisfaction of Workers in the Mining Industry

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### ABSTRACT

The negative consequences of shift work on workers' health and safety increasingly ignored. The major effects include health effects and effects on quantity of sleep, alertness, life satisfaction, and job performance. The aims of this study were to investigate the relationships between shift work and related health effects and shift work and workers' satisfaction in workers of mining industry located in south-west of Iran. All workers of the mining industry were enrolled in this cross-sectional study in 2013. Data were collected by survey of shift workers (SOS) questionnaire. Subjects were divided into case and control groups. The case group included 155 workers employed in shift work schedule and the control group included 104 workers employed in regular day shifts. SOS questionnaire includes questions about demographic features of workers, shift system, health effects of shift work, and the effect of shift work on workers' life satisfaction. Comparisons between the two groups were performed using the chi-square and t-test. The effects of shift work on sleep disorder ( $P=0.001$ ), tiredness related to shift work ( $P=0.001$ ), and workers' personal ( $P=0.003$ ) and family ( $P=0.005$ ) life satisfaction were significant. The result of chi-square test indicated that workers in the shift work system spent fewer hours with their families ( $P=0.05$ ) compared with day workers. Comparisons of findings between the shift workers and day workers in study mining industry revealed that shift work is a risk factor for a number of health effects in shift workers. Workers' personal and family life satisfaction has been affected by shift work.

**KEYWORDS:** *Shift work, Health effect, Life satisfaction, SOS questionnaire*

### INTRODUCTION

Approximately, 20% of all workers in industrial units of the developed countries are employed on night shift work or rotating shift schedule [1]. Shift work has been characterized as an unusual or irregular work schedules and working outside normal daily working hours [2]. There is no doubt that shift work has been associated with a number of problems for human health such as sleep disorders, diseases of the

gastrointestinal system, metabolic system disorders, and increase in the accident probability [3]. Some of these symptoms were temporary or related to particular stages of shift-work schedule such as night-shift work. These symptoms disappear during holidays or day shift schedule. Sometimes these symptoms might indicate the risk of chronic disease [4]. The prevalence of gastrointestinal disorders was higher in shift workers compared with that in day workers [5]. There are multiple risk factors for cardiovascular disease. Several attempts have been made to

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identify the causal relation between shift work and cardiovascular disease. Some previous research findings have revealed the effects of exposures to noise, vibration, chemical agents, and working in a shift system on cardiovascular system [6]. Psychosocial risk factors, as well as job factors such as the organization of work, work programs, and behavior, may lead to increased risk of cardiovascular disease [4, 7]. Few studies have investigated the association between cancer risk and shift work. However, recently, research findings have reported the association between night shift work and risk of breast cancer in women aged 35-54 [8]. The association between shift work and having metabolic syndrome and increased risk of diabetes is reported [9-11]. Shift work has been identified as a major cause of disturbed sleep and sleepiness in shift workers [12].

Shift work can affect the quality and quantity of sleep in workers. The most important concerns related to shift work were sleep disorder, insomnia, fatigue, and occupational disease and injury [13]. About 26% of workers working on night shifts and rotating shift-work were suffered from sleep disorders [14]. There is a negative relationship between working on shift work and the quality of social and family life. Shift work and job schedule adversely affected workers' family life and a poorer quality of life were observed in shift workers especially in those working in permanent night shifts compared with day workers [15-17].

Occupational accidents occurred during shift work had greater or serious consequences compared with accidents occurred in day shifts. The most important cause of accidents in shift workers was sleep disruption, fatigue, and circadian rhythm disruption [13].

Many workers are employed in shift work arrangements (permanent night shifts and rotating shift schedule) in mining industries in Iran. These workers are occupationally exposed to harmful agents in their work environment. They may additionally suffer from the effects of shift work and its consequences. There is a large volume of published studies describing the health effects of shift work and its effects on social and family life of shift workers in Iran. Besides, there has been little discussion about the effects of shift work on the health of mining workers and the consequence of shift work on the workers' social and family life.

The objectives of this research were to determine the relationships between shift work and related health effects and shift work

and workers' satisfaction in workers of the mining industry located in south-west of Iran in 2013.

## MATERIALS AND METHODS

Census method was used to determine the sample size and all 259 workers of a mining industry were enrolled in this cross-sectional study. The case group included 155 workers employed in shift work schedule and the control group included 104 workers employed in regular day shifts. The relevant ethical issues were considered in all stages of the research.

Survey of shift workers (SOS) questionnaire was used to collect data on effects of shift work. The questionnaire assesses the effects of shift work on workers' health and included questions about demographic variables of workers and personal, social and family life satisfaction among shift workers. The questionnaire gathered data on musculoskeletal disorders, health status, information about a job, mental health status, sleep patterns of shift workers, and work shift systems. The SOS questionnaire includes 57 questions for shift workers. Eleven items asked questions regarding demographic characteristics of workers, and the remaining questions are about sleep disorders, life dissatisfaction, and other health related disorders such as psychological, cardiovascular, gastrointestinal, and musculoskeletal problems. Day workers answered to 44 questions after removing the items associated with shift working. The validity and reliability of the SOS questionnaire were assessed in Iran [18].

Internal consistency coefficients for SOS questionnaire was 0.81 [18]. Data analysis was performed using SPSS 16 (Chicago, IL, USA) for Windows. Data were analyzed using chi-square and t-test. The results were significant at the  $P=0.05$  level.

## RESULTS

**Demographic data and work shift systems:** The subjects' mean age in the case group (shift workers) was 29 yr (standard deviation (SD), 4.38); and the mean age for workers in the control group (day workers) was 30 yr (SD, 5.41). There were no significant differences between the two groups for age. Among shift workers (155 workers), 80% were married, 15.5% engaged in second-job (moonlighting), the education levels of 63.9% of them were diploma, and 141 workers (91%) were employed in permanent night shift, 11 workers (7%) were employed in permanent evening shift, and 3 workers (2%) were employed in rotating shift schedule. Table 1 presents the demographic characteristics of workers in the case and control groups.

**Table 1.** Demographic characteristics of workers in the case and control groups

Variable		Shift workers		Day workers	
		Number	Percent	Number	Percent
Marital status	Single	31	20.0	18	17.3
	Married	124	80.0	86	82.7
Education level	Under diploma	24	15.5	39	37.5
	Diploma	99	63.9	36	34.6
	Associate degree	18	11.6	13	12.5
	Bachelor's or higher degree	14	9.0	16	15.4
Engaging in moonlighting	Yes	24	15.5	5	4.8
	No	131	84.5	99	95.2

**Shift work and life satisfaction (social/personal/family life):** The results obtained from the comparing of life satisfaction among shift workers and fixed day workers suggested that there was statistically significant difference in the level of life satisfaction among the shift workers and day workers. Shift workers reported lower levels of life satisfaction than day workers and the levels of personal life satisfaction were significantly lower in the shift worker population than in control subjects ( $P=0.003$ ). There was a statistically significant

difference ( $P=0.005$ ) in the levels of family life satisfaction for the two studied groups and shift workers had lower levels of family life satisfaction. There was no significant difference ( $P=0.24$ ) in the levels of social life satisfaction between the two groups. The results of chi-square test revealed that shift workers spent significantly fewer hours ( $P=0.05$ ) with their families than day workers. Table 2 shows the number of dissatisfied subjects in the two groups.

**Table 2.** The number of dissatisfied workers in the case and control groups

Workers' satisfaction	The number of dissatisfied workers		P-value
	Shift workers	Day workers	
Personal life	53	29	0.003
Family life	62	28	0.005
Social life	62	32	0.240

**Health effects related to shift work:** The results of comparisons between the shift workers and fixed day workers revealed statistically significant differences between the working in shift system and fatigue ( $P=0.001$ ), and working in shift system and sleep disorders ( $P=0.001$ ). Approximately, 13% of shift workers used sleeping pills as sleep aids to help them fall asleep during the day. The chi-square test also showed that the prevalence rates of some health complaints such as headache and nervousness were higher in shift

workers than day workers but not significantly ( $P=0.24$ ). In the case group, 13% had cardiovascular complaints, 15% said that they had suffered from shoulder pain, and 18% of the shift workers suffered low back pain. The prevalence rates of gastrointestinal problem and high blood pressure were higher in shift workers than in day workers, but not significantly ( $P>0.05$ ). Table 3 compares the results obtained from the assessment of the health status of shift workers and day workers.

**Table 3.** Comparison of health status between the shift workers and day workers

Health status variables	Number of workers		P-value
	Shift workers	Day workers	
Insomnia	96	59	0.400
Sleep problems	83	33	0.001
Low back pain	23	12	0.430
Shoulder pain	27	15	0.390
Loss of appetite	62	30	0.290
Cardiovascular complaints	19	10	0.470

## DISCUSSION

Shift work has negative effects on workers' personal and family life satisfaction. The results of this study showed that the levels of personal, family, and social life satisfaction of the

shift workers were lower than those of the day workers. Shift work, especially night shift work, had negative effects on the quality of life and life satisfaction of workers and workers' quality of life are likely to be affected by shift-work system [17]. The results of the cross-sectional study on the

effects of shift work on family satisfaction showed significantly lower levels of family satisfaction in shift workers (working on the night and evening shifts) than day workers [19]. Shift workers were spent fewer hours with family that can lead to lower levels of family satisfaction among them. Some previous research indicated that reducing working hours of shift workers could lead to higher levels of family satisfaction and spending more time in family [17, 19].

There was a significant relationship ( $P=0.001$ ) between working in shift system and sleep disorders. Working on irregular working hours such as night shift work can induce circadian rhythms disruption [20]. Sleep disorders were common in shift workers as mentioned in some studies [4, 20-21]. Approximately, 75% of shift workers suffer from sleep disorders [22]. Sleep disorders in shift workers are due to irregular working hours, and the number of hours of sleep for shift workers is 5-6 h and sleep duration during daytime is lower (1-4 h) than that during night time. The prevalence of loss of total sleep time is high among night-shift workers than evening and slow rotating shift schedules [20]. Fatigue is a common complaint among shift workers on irregular working hours [5]. The findings of the current study are consistent with those of other studies and suggest that the rate of fatigue is higher in shift workers than day workers [5, 23]. Shift workers suffer more from fatigue than day workers do.

Higher prevalence rates of high blood pressure, cardiovascular complaints, and gastrointestinal complaints were reported for shift workers than day workers, although there were no statistically significant differences. A higher prevalence of cardiovascular risk factors was reported for shift workers [24-26]. Shift work was considered as an independent risk factor for increased blood pressure among Japanese men [27]. Evidence provides support for a high prevalence of gastrointestinal symptoms in shift workers [28-29]. The prevalence of gastric ulcers among 11657 subjects employed on shift systems in factories, banks, and schools was 2.38% ( $N=54$ ), which was higher than the prevalence of gastric ulcers among daytime workers (1.52%) [30]. Our findings suggested the higher number of shoulder and low back pain complaints among shift workers than day workers. The prevalence of musculoskeletal symptoms in lower back, neck, and shoulders of shift workers was higher than day workers in the study conducted to assess the association between shift working and musculoskeletal symptoms among nursing personnel. Shift working could be considered as a risk factor for increased prevalence of lower back disorders [31].

Given that many mining industry workers are employed on shift systems and are exposed to health risks posed by shift work, proper management, and appropriate changes can lead to reduction in health risks related to shift work. Planning appropriate shift patterns leads to increases in the levels of satisfaction among shift workers. Reduction of work hours would lead to reduction of adverse effects of shift work. Conducting training programs and describing the health consequences of shift work allow workers to increase their knowledge about health problems of shift work.

## CONCLUSION

Shift work is a risk factor for a number of health effects in shift workers. Shift work has negative effects on workers' personal and family life satisfaction. Sleep disorders and complaints were more common among the shift workers than the day workers were. The prevalence rates of high blood pressure, cardiovascular complaints, and gastrointestinal problems were higher in shift workers than in day workers in the study mining industry. Shift workers reported more shoulder and low back pain complaints than day workers did. Further studies are needed to investigate and identify the effects of shift work on workers' health and satisfaction in mining industries. Arranging better working hours and schedules according to ergonomic principles can minimize the effects of shift work on workers' health.

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