

The Correlation between Occupational Unsafe Acts and Job Burnout among Workers in Kashan Metal Melting Industries 2017

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Abstract

Aim: Literature in workplace safety has classified the causes of occupational accidents into unsafe conditions and unsafe acts. Job burnout can lead to loss of quality and efficiency of the individual, reduce physical and mental health, and may cause to increase of unsafe acts. The purpose of this study was to investigate the correlation of unsafe acts with job burnout among workers of Kashan smelting industries. **Materials and Methods:** This cross-sectional study was conducted on 112 workers of metal melting industries. The unsafe acts of them were monitored through observation and using the Tarrant's checklist. The examination of burnout was carried out using the Maslach questionnaire. The demographic data were also collected by a researcher-made questionnaire. The results were analyzed using the Chi-square test, independent *t*-test, and analysis of variance. **Results:** The results indicated that 43.23% of workers' behaviors were unsafe. The most frequent unsafe act was the fail to using personal protective equipment (38.1%), and the least frequent was inadvertency (0.07%). There was a significant relationship between smoking, work units, safety education, and working hours with unsafe acts ($P < 0.05$). There was no significant relationship between the dimensions of occupational burnout with unsafe acts. **Conclusion:** The prevalence of unsafe behavior in the metal smelting industry is relatively high, and job burnout cannot be used as an appropriate indicator to predict unsafe acts in metal melting industry. Planning for safety training to workers and the setting of suitable work hours can be used as effective strategies to reduce unsafe acts.

Keywords: Job burnout, metal smelting industries, occupational accidents, unsafe acts

INTRODUCTION

Occupational accidents are the 3rd leading cause of death in the world and the 2nd leading cause of death in Iran after automobile accidents, and one of the most important factors which put health, social, and economic situations in danger, in industrial and developing societies.^[1] Considering the importance of controlling the incidence rates, various investigations and models have been presented on the causes of accidents, which in most of them, two factors of unsafe acts and unsafe conditions are mentioned as the most important causes of accidents.^[2]

The accidents of the iron and steel industry, are due to its processes, more than in the other industries. Processes such

as the spreading, the explosions, the discharge and hurling of molten metal or lava, furnace fillers, cranes and ladles (cauldron of molten metal) falling objects, and obstruction of workshop floors and paths. Most of the hazards are multiple, like dropping of a molten metal cauldron from a crane moving along a busy path.^[3] The main cause of most accidents is unsafe acts.^[4]

In industrial societies, occupational burnout has become widespread and encompasses all aspects of people's lives.

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On the one hand, it triggers divorce, resignation of jobs, and mental and physical illnesses, and on the other hand, it induces the reduction of productive workforce and economic blow and also deteriorates production potential of the country. This phenomenon endangers all dimensions of society.^[5]

Based on the scientific literature, burnout is correlated with the requirements and resources of the job^[6] and is not limited to individuals and can reflect on the entire team and organization.^[7]

Job burnout is one of the major occupational issues, which impose significant expenses on organizations. For example, in the United States, expenses of organizations associated with burnout are estimated to be 50–70 USD million/year.^[8]

The purpose of this research was the identification of management, and some psychosocial variables affecting the occurrence of accidents in the metal smelting industry as one of the most unsafe occupations, in order to more deeply identify psychological and social factors affecting accidents and to help programs of accident prevention and progression of safety and health level and also to examine the correlation of unsafe occupational acts with job burnout of employees of Kashan metallurgy industry.

MATERIALS AND METHODS

This research is a cross-sectional study, and all personnel involved with molten materials (112 people) employed in four smelting factories were included in the study through census. In this study, researcher-made questionnaires were used to collect the demographic data of individuals including age, gender, related work experience, number of completed courses, level of education, and number of occupational accidents. The number of work accidents reported by the workers themselves was matched with the documentation of the company to ensure the accuracy of the information and increase the accuracy of analyses.

In this research, the Tarrant's checklist was used for sampling the unsafe acts. In this checklist, eight groups of unsafe acts are examined, each of which includes smaller subsets and the percentage of unsafe acts of each person in eight behavioral groups (in accordance with the Tarrant's checklist) is assessed. After measuring and assessing unsafe acts in the specified groups, the total percentage of unsafe behavior of each person was determined using the following formula:

The percentage of unsafe acts of each person = (unsafe acts/total acts) × 100

Before the start of the main observations, a preliminary study is first carried out with two objectives as follows:

- Determine the unsafe actions of workers of the metal smelting industry that may not exist in the Tarrant's checklist. For this purpose, according to the literature, 200 systematic observations of workers' attitudes were performed, and unsafe acts which were not included in the main Tarrant's checklist were added to this list^[9]
- Determination of the number of observations required, to record and investigate the unsafe actions of the

workers: in this regard, based on the results of the preliminary study and the ratio of unsafe acts to total acts of workers, and considering the accuracy of 6% of the prevalence and confidence level of 95%, the number of required observations was estimated 3287 (Average 35 observations per worker).^[10] After completing the preliminary study, the main observations were carried out to the mentioned number surreptitiously. The average duration of each observation in this study was 3 s.

A demographic questionnaire including information, such as age, marital status, work experience, education degree, job type, type of work unit, smoking rate, type of shift work, the degree of interest in the job, hours of training in safety and specialties related to job, was completed by all the workers who were under the study.

Maslach *et al.*'s questionnaire is the most common tool for measuring burnout, which consists of 22 distinct items about feelings and attitudes and measures three dimensions of burnout syndrome included emotional exhaustion, depersonalization, and decreased of sense personal accomplishment.^[11] The scores obtained in each dimension of burnout according to frequency and intensity are classified into three classes such as low, moderate, and severe.^[12] Validity and reliability of the Persian version of this questionnaire have been confirmed in the previous studies, and its reliability coefficient has been reported through a test–retest method of 0.78.^[13]

For data analysis, Kolmogorov–Smirnov test was used to normality test of the data. Chi-square tests were used for qualitative variables; independent *t*-test and ANOVA tests were used for quantitative variables. Data analysis was performed through the SPSS ver 16 (SPSS Co, Chicago, ILL, USA).

RESULTS

The study was conducted on 112 workers working in the metal smelting industries who were in direct exposure to molten materials and based on 3287 observations. The youngest worker was 21-year-old, and the oldest one was 55-year-old. The largest number of workers who were directly exposed to molten materials belonged to the casting unit (27.7%). 23.2% of the individuals were not holding a diploma degree, 41.1% were high school graduate, and 35.7% were university graduate. 78.6% were married, and 74.1% had rotational shift work. 47.3% of the people were interested in their jobs, and 4.5% of the people were completely uninterested in their jobs.

81.2% of individuals had accomplished health and safety training course, and 71.4% of them had been trained in specialties related to their jobs. 88.4% of individuals did not smoke, and 86.6% of personnel did not have a second job. 66.1%–33.9% of the workers were working 8 h–12 h, respectively. 42.8% of workers have not experienced a job accident until now. The Kolmogorov–Smirnov test showed the normality of data.

As shown in Tables 1 and 2, the mean and standard deviation of the percentage of unsafe acts to the total observed acts have

been indicated, respectively, based on demographic data and occupational characteristics.

As it can be seen, there was no significant relationship between factors of personnel's age, work experience, education and marital status, and the ratio of unsafe acts ($P = 0.145$, $P = 0.387$, $P = 0.197$, $P = 0.348$). The ratio of unsafe acts was 54.94% among smokers while was 43.93% among nonsmokers, which is statistically significant.

Furthermore, according to the results of Table 2, the highest percentage of unsafe acts was related to the casting unit, and the least was related to the Properzi unit. There was a significant relationship between the percentage of unsafe acts and the work unit ($P < 0.001$), safety and health training related to work ($P = 0.022$), and working hours ($P = 0.002$). However, with other job variables, this relationship was not significant.

According to Table 3, 10.7%, 21.4%, and 67.9% of the individuals have reported high, moderate, and low emotional exhaustion, respectively; and the intensity of them was 8.9%, 8%, and 83%, respectively. The results of the frequency and intensity of the other two dimensions are clearly indicated in Table 3.

The results in Table 4 show that there is no significant relationship between the frequency and also intensity of each aspect of burnout with age.

However, in Table 5, there was a significant relationship between the frequency of emotional exhaustion and work experience ($P = 0.032$). The other dimensions of occupational burnout (in terms of both intensity and frequency) have no significant relationship with work experience.

As shown in Table 6, there is no significant difference in the average percentage of unsafe acts in the two groups with low and high levels in different dimensions of burnout.

DISCUSSION

In this article, based on the type of unsafe acts, out of 3287 of general observation of safe and unsafe acts, 2693 cases have been of unsafe acts which are equivalent to 22.23%. In a similar research by Mohammadfam, in the study of unsafe acts of casting factory workers, this ratio was 59.2%, and in another study, the amount of unsafe behaviors in an automobile factory was reported 35.4%. Kakaei *et al.* have reported 24.5% of acts as unsafe behaviors in an oil refinery.^[14,15]

In this study, there was no significant relationship between the age of personnel, work experience, education, marital status, and unsafe behavior, while the results of other studies indicate that the higher the age of a person is, the more likely they are to commit unsafe acts,^[16-19] Chau *et al.* and Salminen studies also demonstrate that the occurrence of the accident decreases with the increase of occupational experience,^[20,21] and the results of previous studies show that people with university graduates have fewer unsafe acts than other groups (people with diploma degree and under that).^[17,19,22-25] The reason for

Table 1: Mean and standard deviation of percentages of unsafe acts to total observation according to demographic data

Variable	Status	n	X±SD	P
Age	<29 years	33	42.51±14.06	0.348*
	30-39 years	58	44.63±20.8	
	>40 years	21	50.88±29.01	
Work experience	<9 years	63	47.43±14.9	0.197**
	>10 years	49	42.27±24.22	
Education	Under the diploma	26	47.03±20.73	0.387*
	Diploma	46	47.32±21.5	
	University	40	41.5±20.5	
Smoking	Yes	13	54.94±22.41	0.044*
	No	99	43.89±20.54	
Marital status	Single	24	39.64±15.35	0.145*
	Married	88	46.68±22.08	

*ANOVA test, **Independent *t*-test. SD: Standard deviation

Table 2: Mean and standard deviation of percentages of unsafe acts to total observation according to occupational characteristics

Variable	Status	n	X±SD	P
Unit of work	Casting	31	25.46±58.43	<0.001*
	Parsing	22	18.27±34.8	
	Technical	21	16.69±35.78	
	Stoke production	26	13.54±48.79	
	Others	12	12.15±38.57	
Safety and health education	Yes	91	20.37±43.01	0.022**
	No	21	21.37±54.55	
Specialized training	Yes	80	19.52±43.39	0.155**
	No	32	23.94±49.64	
Type of work shift	Fixed	29	21.87±45.61	0.897**
	Rotational	83	20.77±45.02	
Hours of work (h)	8	74	23.21±40.88	0.002**
	12	38	12.13±53.53	
Having a second job	Yes	15	26.6±40	0.306**
	No	97	20±45.97	
Interest in the job	Low	11	16.68±51.16	0.594*
	Medium	48	22.66±45.05	
	High	53	20.28±44.04	
Having an incident	Yes	64	25.13±42.41	0.107**
	No	48	121.91±48.86	
Witness the incident	Yes	67	22.26±45.92	0.647**
	No	45	19.05±44.06	

*ANOVA test, **Independent *t*-test. SD: Standard deviation

this can be the difference in the number of samples and types of society under the study.

The lack of prudence hinders progress in the professional and educational fields. People who have not seen adequate training at the beginning of their career will face difficulties due to the lack of appropriate strategies for coping with work stress. By acquiring coping skills and mastering the relevant expertise, and with adaptation to the occupational environment and factors, they will be less inclined to experience burnout.^[26]

The results of the study indicated that workers of the casting unit had significantly the highest amount of unsafe acts, which show that the work unit has an impact on the occurrence of unsafe acts, and the high-risk unit also has an effect on absent-mindedness and incautiousness that trigger unsafe act. There was significant inverse relationship between unsafe acts and occupational safety and health training ($P = 0.022$), and also between unsafe acts and working hours ($P = 0.022$), and this ratio shows that the workers who attend in health, safety, and professional training courses related to their jobs will experience fewer unsafe acts and consequently fewer accidents, and the higher the level of wisdom and knowledge of the individual in terms of health and safety issues is his human error and consequently, the probability of high risk and unsafe behavior done by him will be lower.

The variables of marital status, job shift, having a second job, the amount of interest in the job, the number of accidents, and witnessing accident have no significant relationship with unsafe acts. The rate of smoking (with a confidence coefficient of 93%) has a significant relationship with the unsafe acts,

which this ratio shows that people who are smoking have more human errors, and these people have tendency to high-risk behaviors, so they will commit more unsafe acts; and eventually, they will face more accidents in work. In terms of the working hours, the occurrence of incidence was higher among the workers who worked 12 h, which can be the result of fatigue caused by work and absent-mindedness. Researchers believe that occupational accidents can be controlled by reforming behavior.^[27] Encouraging employee's safe behaviors can be effective far more than punishing unsafe behaviors in reducing accidents.^[28] The best person who can help the organization to reform unsafe behaviors is the worker himself, and engagement and interaction can have a positive effect on the safety performance of the organization and the safety atmosphere.^[27,29]

Findings indicate that there is no significant relationship between the frequency and intensity of each dimension of burnout with age, but there is a significant relationship between the frequency of emotional exhaustion and work experience. While Saberi *et al.* by conducting a study on school teachers demonstrated that the frequency of job burnout decreases by the increase of age.^[30] Furthermore, in Asghari *et al.* study, the results indicated that there is no significant relationship between age and work experience with job satisfaction and job burnout using Spearman test, which can be due to differences of the studied societies.^[31] According to the results of this study, there is no significant relationship between the dimensions of occupational burnout (both intensity and frequency) with unsafe acts, while findings of other researches confirm the positive and significant relationship between occupational accidents and burnout in

Table 3: Distribution of frequency and intensity of burnout in different dimensions

Dimensions of burnout	Indicator	Low	Medium	High
Emotional exhaustion	Frequency	76 (67.9)	24 (21.4)	12 (10.7)
	Intensity	93 (83)	9 (8)	10 (8.9)
Depersonalization	Frequency	84 (75)	18 (16.1)	10 (8.9)
	Intensity	82 (73.2)	21 (18.8)	9 (8)
Decreased of sense personal accomplishment	Frequency	92 (82.1)	11 (9.8)	9 (8)
	Intensity	95 (84.8)		17 (15.2)

Table 4: Distribution of frequency and intensity of burnout in different dimensions according to age

Dimensions of burnout	Indicator	Age (years)			Total	P*
		<29	30-39	>40		
Emotional exhaustion	Frequency	9 (27.3)	36 (32.1)	9 (42.9)	36 (32.1)	0.473
	Intensity	6 (18.2)	19 (17)	6 (28.6)	19 (17)	0.22
Depersonalization	Frequency	6 (18.2)	28 (25)	5 (23.8)	28 (25)	0.494
	Intensity	9 (27.3)	30 (26.8)	5 (23.8)	30 (26.8)	0.943
Decreased of sense personal accomplishment	Frequency	4 (12.1)	20 (17.9)	5 (23.8)	20 (17.9)	0.523
	Intensity	5 (15.2)	17 (15.2)	5 (23.8)	17 (15.2)	0.438

*Chi-square test

Table 5: Distribution of frequency and intensity of burnout in different dimensions according to work experience

Dimensions of burnout	Indicator	Work experience (years)		Total	P*
		<9	>10		
Emotional exhaustion	Frequency	15 (23.8)	36 (32.1)	0.032	21 (42.9)
	Intensity	11 (17.5)	19 (17)	0.874	8 (16.3)
Depersonalization	Frequency	16 (25.4)	28 (25)	0.912	12 (24.5)
	Intensity	17 (27)	30 (26.8)	0.957	13 (26.5)
Decreased of sense personal accomplishment	Frequency	9 (14.3)	20 (17.9)	0.263	11 (22.4)
	Intensity	11 (17.5)	17 (15.2)	0.445	6 (12.2)

*Chi-square test

Table 6: Mean and standard deviation of percentages of unsafe acts to total observation in two groups with low and high job burnout

Dimensions of burnout	status		P*
	Low	High	
Frequency			
Emotional exhaustion	18.71±44.09	25.21±47.46	0.43
Depersonalization	19.34±44.42	25.48±47.44	0.511
Decreased of sense Personal accomplishment	19.46±46.8	26.11±37.71	0.07
Intensity			
Emotional exhaustion	19.46±43.93	26.96±51.27	0.165
Depersonalization	19.91±44.32	23.8±47.52	0.476
Decreased of sense Personal accomplishment	21.37±45.44	19.02±43.69	0.753

*Independent *t*-test

employees.^[32-35] Maslach and Leiter believe that accidents resulting from potential work in the work environment lead to job stress, and ultimately will result in burnout over a long period.^[36] It seems that the impact of other factors, such as hours of work, unit of work, and safety and health education on insecure acts, is more than burnout.

With these elucidations, according to Diner and Lucas's view, the causes of job burnout include personal stressors (expectations and motivation), interpersonal stressors (contact with clients and relationships with colleagues and managers), and organizational stressors (job resignation, administrative regulations, and occupational stress). In this classification, occupational accidents can be considered as one of the organizational stressors that even thinking about the occurrence of it precipitates emotional distress and naturally, employees' awareness of the probable occurrence of accidents act as a stressor which exacerbates the intensity of emotional exhaustion.^[37]

A radical change in the safeguarding of the working environment, the application of proper management practices, job rotation, continuous review of prior to employment training needs, greater supervision at all levels of work by all leaders of organization, and the creation of a safe thinking among all officials in such a way that safety is the duty of all officials as an intrinsic part of managerial and engineering thinking, which will be helpful in the reduction of occupational accidents in this industry. According to the results of the statistical analysis, it can be concluded that in the study groups where the stress level is higher, unsafe behaviors are more and as a result, the number of accidents and the resulting damages are more.

CONCLUSION

The prevalence of unsafe acts in the metal smelting industries is relatively high, and job burnout cannot be used as an appropriate indicator to predict unsafe acts. Planning for safety training to workers and the setting of suitable work hours can be used as effective strategies to reduce unsafe acts.

Limitations

Among the research limitations is the lack of cooperation of some directors and employers of the metal smelting industry, which could be due to a lack of trust in the researchers to transfer company information. Another limitation was the rapid occurrence of workers' behavior, so the researcher must have a decent focus on the behavior of the worker.

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Conflicts of interest

There are no conflicts of interest.

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