Journal of Human, Environment and Health Promotion

Journal homepage: www.zums.ac.ir/jhehp

The Evaluation of Safety Culture in Gas Stations in the City of Zanjan

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A R T I C L E I N F O

A B S T R A C T

Background: Gas stations are one of the most well-known risky potentials in cities. Attitude and culture are underlying reasons for unsafe behaviors, which can lead to accidents. This study aimed to evaluate safety culture among workers of gas stations in the city of Zanjan.

Methods: In this descriptive analytical study, a valid safety culture questionnaire consisting of five dimensions was used. The study population included all workers in gas stations in the city of Zanjan. The questionnaires were completed, after getting consent from the subjects. Then, the data were introduced into SPSS 9 for analysis. Statistical tests such as t-test, Spearman and Pearson correlation were used with the significance level of 0.95.

Results: The studied individuals enjoyed good attitude about safety culture, and the mean safety culture score of them (151.1) was assessed as acceptable. The relationship between work experience (P_{value}=0.015), age of subjects (P_{value}=0.020) with safety culture were significant.

Conclusion: The results of this study indicate that training is considered an important dimension among safety culture dimensions. As the score obtained for this dimension is lower than other dimensions, it can be promoted through different solutions including the organization of briefing classes and installment of safety signs.

1. Introduction

Technology improvement and workplace safety have brought a plenty of achievement in accident control in industries [1]. Yet, a large number of workers die due to work-related accidents [2]. By Chernobyl disaster, questions were posed about the relationship between major accidents and defects in organizational system and safety management systems, which in turn further highlighted as safety culture [3].

Since then, a considerable of studies have been carried on safety culture. For example, Saleh et al.,

(2013) explored the pathology of the factors affecting the accident of explosion of Texas refinery and found that a combination of factors associated with operational design and defects, technical and organizational factors, and more extensively poor safety culture have caused the accident [4].

Safety culture can be defined as an understanding of an aspect or parts of an organizational culture, which can influence attitudes and behaviors, through which it affects the organizational safety level.

In addition, through safety culture, one can minimize exposure of employees, managers, customers, and ordinary people to risky conditions [5, 6]. Safety culture includes prevention and diagnosis programs, which enhances awareness of employees and reduces costs associated with injuries [7]. Now, it is well known that human's unsafe acts caused 70–90% of the accidents (Bahr 2014). Workers' beliefs, attitudes and behaviors can, therefore, play a significant role in accidents occurring and people life-saving [1].

Along with socio-economic development, gas stations increasingly spread. Therefore, beliefs, attitudes and behaviors of workers should be evaluated to be ensured about safety in gas stations. This study aimed to evaluate the safety culture in gas stations in the city of Zanjan.

2. Materials and Methods

This descriptive analytical study was conducted across all gas stations in the city of Zanjan (10 stations). The study population consisted of all workers in these sites in Zanjan, whereby 124 subjects were included according to census. To follow ethical considerations in the research, the questionnaires were completed after justifying and receiving the consent of the participants. This study was performed using standard questionnaire. This questionnaire included 42 items consisting of five dimensions of safety culture including management commitment, level of information exchange, education, workplace, and safety priority. The reliability and validity of the questionnaire had been developed by Arghami et al., [8] which had no special name.

The collected data were fed into SPSS 16.0. Scoring two questionnaires was performed based on 5-item Likert scale (absolutely disagree, disagree, no idea, agree, and absolutely agree).

To determine the status of safety culture governing the stations, the following formula was used [9]:

$$\mu = \frac{5 \times k + k}{2}$$

Where k is the number of items and μ represents the mean (cut-off point) score of safety culture. According to the number of questionnaire items (42 items), the mean score of safety culture is calculated by the following formula:

$$\mu = \frac{5 \times 42 + 42}{2} = 126$$

Therefore, if the obtained score is less than 126, then safety culture is undesirable; 126-168 represents relatively desirable; and 168+ is considered desirable.

The questionnaire was provided to the workers in person and explanations were given to them about the way they were going to fill the questionnaire. After introducing the collected data into SPSS 16.0, the mean value of every single safety culture dimension available was examined. To investigate the demographic information (marital status, age, level of education, work experience) of the subjects, statistical tests with the significance level of 0.95 were employed.

To explore the relationship between marital status and safety culture, t-test was utilized. To study the relationship between the level of education and safety culture status, one-way ANOVA was employed.

Finally, to determine the relationship between safety culture and age, work experience of the subjects, Pearson and Spearman correlation coefficient was used.

3. Results and Discussion

Since unsafe behavior is an underlying cause of accidents and it is in the relationship with safety culture [10], assessment of safety culture is crucial in the high-risk environment as gas stations. This study is a descriptive-analytical research conducted on 124 workers across 10 gas stations in Zanjan, Iran with the aim of determining safety culture level of workers in these sites. The analysis indicated that the mean age of the studied group was 29.16±4.12 years old. A high percentage of individuals (80.6%) were married and most of them had an academic level of below diploma with a proportion of 63.7%. The average work experience of the employees was 5.5 years. Having analyzed the questionnaire data, it was found that the mean score of the safety culture of the workers at gas stations in the city of Zanjan was 151.1. Therefore, the safety culture among these workers can be considered as relatively desirable. Table 1 provides the distribution of scores of safety culture dimensions at gas stations in the city of Zanjan.

Table 2 presents the distribution of safety culture score among the workers across the 10 gas stations in the city. Among the stations, Station 6 and Station 9 claimed the maximum (158.62) and minimum (141.12) scores, respectively. Generally speaking, however, all stations had an acceptable safety culture situation (μ≥126).

Furthermore, the results of the five scores of safety culture related to the 10 stations have been shown in Table 3. As can be observed, among the five dimensions, management commitment ($\mu \geq 54$) and safety priority ($\mu \geq 15$) enjoyed a more acceptable situation.

Table 1: Distribution of Scores of Safety Culture Dimensions at Gas Stations in the City of Zanjan.

Safety Culture Dimensions	The Mean Acquired Score
Management commitment	69.45
Safety Communication	18.35
Education	17.47
Working Environment	23.45
Safety Priority	22.37

Table 2: Distribution of Safety Culture Score Across 10 Gas Stations in Zanjan.

Site No.	The Mean Safety Culture Score	Standard Deviation	Status
Site 1	155.12	14.41	Acceptable
Site 2	147.06	23.00	Acceptable
Site 3	152.75	11.52	Acceptable
Site 4	141.83	27.72	Acceptable
Site 5	149.68	22.11	Acceptable
Site 6	158.62	10.95	Acceptable
Site 7	152.58	13.10	Acceptable
Site 8	155.08	21.08	Acceptable
Site 9	141.12	17.10	Acceptable
Site 10	154.50	15.50	Acceptable

The t-test indicated that there is no significant relationship between marital status and safety culture (P_{value}=0.849). To investigate the effect of level of education on the score and five dimensions of safety culture, one-way ANOVA test was employed. The obtained results reveal that except for working environment (P_{value}=0.030) and safety priority (P_{value}=0.027), there is no significant relationship between the level of education and other safety culture dimensions. To examine the effect of work experience and age of the people on safety culture score, Pearson correlation test was utilized. It was found that there is a significant relationship between work experience (P_{value}=0.015) as well as age (P_{value}=0.020) and safety culture.

Further, the relationship between age and safety culture dimensions through Spearman correlation tests showed only a significant relationship between management commitment (P_{value}=0.015) and education (P_{value}=0.015).

The findings indicated that the mean safety culture score of the workers was acceptable (151.1). The safety culture of workers in gas stations in this city can be considered relatively desirable.

Although various factors affect the formation of a positive safety culture, the studies conducted in this regard suggest that management plays the key role in this regard. The study by Fernandez et al. called "safety culture" well suggests that managers play a significant role in promoting safety behaviors of workers both directly and indirectly [3]. In the present study, management commitment and education with the mean values of 68.7 and 13.88 claimed the maximum and minimum scores, respectively.

Accordingly, one can be very optimistic about the promotion of safety culture across gas stations in Zanjan, as the management commitment enjoys a favorable status.

In this study, no significant relationship was observed between the level of education and safety culture score (P_{value}=0.189). These findings are in line with the results obtained by Shekari et al., (2014) in assessing safety culture in petrochemical laboratories [9]. However, the study by Mohamadfam et al., (2010) in metal industry revealed this relationship as significant [11]. Although there are differing results across various studies, it can be stated that in oil industries, high risk and group damages (resulting from fire and explosion) are important factors in constant emphasis on safety. Thus, in such environments (even assuming the intrinsic effect on the level of education on safety culture score), training and attention in the workplace can be effective more than the level of education. However, in metalworkers, mostly these risks only affect the operator, thus it can be expected that general attention in such industries is less than what is observed in oil industries. Accordingly, the effect of level of education on safety culture score can be observed.

In this study, there was also a significant relationship between the mean value of work experience and safety culture score (P_{value}=0.015). In most studies, such a result has also been discussed, including Mohamadfam [11] and Taghdisi et al., [3]. The existence of a significant relationship between work experience and safety culture level can represent the effect of individual experience.

Further, the positive effect of age in improving safety culture in this study is in line with the results of Mohamadfam [11] as well as Taghdisi et al., [3]. As justification, the relationship between age and work experience can be mentioned;

with age, people's work experience increases, and the

growth of them contributes to improved safety culture.

Table 3: Distribution of Scores of Safety Culture Dimensions Across 10 Gas Stations in Zanjan.

Site No. / Safety Culture Dimension	Management Commitment	Safety Communication	Education	Working Environment	Safety Priority
Site 1	72.87	17.75	17.75	24.00	22.75
Site 2	67.93	17.87	17.25	21.81	22.18
Site 3	70.75	18.85	18.08	23.50	21.83
Site 4	64.75	17.58	16.41	21.58	21.50
Site 5	68.81	19.00	17.12	22.37	22.37
Site 6	72.56	18.62	18.06	26.43	22.93
Site 7	70.91	18.33	17.58	23.33	22.41
Site 8	70.83	17.83	19.00	24.08	23.33
Site 9	65.50	17.62	14.87	21.25	21.87

Table 4: Pearson Correlation Coefficient between Work Experiences as Well as age and Safety Culture Score.

Variable	Work Experience	Age	Safety Culture
Work Experience	-	-	-
Age	.823 **	-	-
Safety Culture	.224*	.204*	-

4. Conclusion

In this study, which was based on a questionnaire method, safety culture was examined among workers.

The results indicated that the safety culture score is acceptable. However, exploring the safety culture dimensions, it was found that the dimension of education (17.47) had the lowest score in comparison to other dimensions. Considering the necessity and high risk of the working environment, it demands special attention by the management. Thus, through pre-employment and periodic compulsory training for workers, one can enhance this dimension to some extent. In addition, using posters and safety signs associated with the working environment and by installing electronic boards "no smoking, no mobile phone", it is possible to elevate both workers' safety and customers' awareness.

Acknowledgement

Limitation

Since the original questionnaire had no cut of point,

in this study the acceptable level of safety culture is based on comparison the mean score of all studied stations.

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