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Survey of Safety Climate and Its Associated Factors in Various Enterprises, 2015-2017

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Abstract

Background: Safety is a part of organizational climate and reflects the workers' current perception toward safety issues in an organization. The aim of this study was to survey the level of safety climate and its associated factors in various enterprises.

Methods: In this cross-sectional study the data were collected using Persian version of Nordic safety climate questionnaires (NOSACQ) which was distributed among 661 employees of different industries in Qazvin Province. This questionnaire consists of six dimensions. The data were analyzed using IBM-SPSS Statistics 2010 and Microsoft office excel. We used the Mann-Whitney Test, Kruskal-Wallis Test, Spearman's Rho-Kendall's Tau-B, Tukey (POST-HOC) and - Way ANOVA tests to find the association between the variables and safety climate scores.

Results: The mean age of the subjects was 29.97±5.53 years; 66% of them were married, 91% were males, 31% had a college degree, 47% were rotating- shift workers, and 80% were employed through contracts. Their average work experience was 17.27±15.4 years. The values of Cronbach's Alpha were acceptable in the study groups; the highest and lowest levels of safety climate were observed in ceramic and mine industries, respectively.

Conclusion: There were some relationships between the safety climate and variables of level of education, work shift, presence of occupational and health department (OH&S) as well as safety management system, age and work shift.

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Introduction

Safety is a part of organizational climate, and according to Zohar (1980) it is the summary of perceptions that employees share about their work environment.[1] Safety climate is defined as a snapshot of safety culture which is employees' shared perception of the managers' and employees' attitudes towards safety.[2]

Safety climate is a part of organizational climate which can be used as the basis for safety management and safety performance assessment. Therefore, the required level of safety climate/culture should be determined only after the current level of organization's safety climate/culture is specified. Finally, the proper mthod should be used to achieve the required level of safety climate.[3]

Safety climate potentially differs across organizations and organizational units. Although many studies have been conducted on the safety climate level in different organizations and industries, a comparative study of differences in the safety climate level across organizations and organizational units is actually rare. Vinodkumar and Bhasi studied the safety climate perception among the employees of high-risk chemical industry in Kerala, India. They concluded that safety climate differed across different industries.[4]

In a similar study, Rasmussen and Tharaldsen compared the safety climate in coastal platforms of Norway to that in Denmark. Their study showed that Norwegian workers had a better perception of safety climate compared to Danish ones.[5]

Singer Hartmann et al. examined the safety climate level in different hospitals of the United States. No variation was observed in the average of safety climate perception between military hospitals and other hospitals. The military hospitals had lower levels of safety climate perception just in some dimensions. The study also showed that personal attributes such as age and managerial occupation led to an increase in safety climate perception and attitude.[6]

Olsen and Aase investigated the differences in safety climate between Norwegian hospitals and oil industries. They used the Patient Safety Culture Questionnaire and made some changes in it to be used for oil industry. Oil industry showed a higher safety climate score compared to hospitals.[7]

Some studies have examined the factors affecting the safety climate level. For example, Vinodkumar et al. showed that there was a direct relationship (0.8-0.9) between safety climate level and personal attributes such as age, job experience, and type of employment.[4]

The present study aimed to investigate the factors affecting safety climate including the type of industry, size, OHS management system, OHS department as well age and work experience of the employees' differences in safety climate level among Iranian industries and organizations using the Persian version of Nordic Safety climate Questionnaire (NOSACQ-50); also, there was an attempt to determine the relationship between safety climate level and variables such as age, educational level, gender, history of workplace accidents, managerial job experience, etc.

Materials and Methods

This cross-sectional study examined the safety climate perception among 658 employees of different industries and organizations including ceramic industries (200 people), steel industries 345(), mines (33), agriculture (40) and hospitals (70). The sample size was calculated with a standard deviation of 50.662, confidence level of 95%, and precision of 7.36.

The Persian version of Nordic Safety Climate Questionnaire-50 was used for this purpose; it was designed by Yousefi, Jahangiri et al.[8] It contained 50 main questions in addition to some information about the company such as management systems and existence of occupational health and safety departments, as well as personal information such as age, gender, managerial job experience, job experience, history of workplace accident, work shift and type of employment. The questions were cored based on a 4-point Likert scale (disagree, strongly disagree, agree, strongly agree). Points 1-4 were used for direct-scored questions and points 4-1 were used for reverse-scored questions.[9]

SPSS (IBM-SPSS Statistics2010) and Microsoft office Excel (2007) were used for data analysis. The safety climate mean score for each dimension was obtained for each subgroup by calculating the scores of direct-scored and reverse-scored questions. Using Mann-Whitney Test, we found the association among the variables such as gender, managerial job experience, history of workplace accident and marital status. Kruskal-Wallis Test was used to find the association between safety climate mean score and variables such as educational level, work shift and type of employment. Moreover, the relationship between safety climate level and variables such as job experience and age was found using (Spearman's Rho–Kendall's Tau-B) correlation coefficients. Comparisons of safety climate dimensions (factors) were made between different study groups via Tukey (POST-HOC) and one way ANOVA tests.

Results

A total of 661 people participated in the study and completed the questionnaires. After deleting the stereotypical responses, 404 questionnaires were analyzed. The demographic characteristics of the study population are presented in Table 1. The mean age of the subjects was 29.97±5.53 years; 66% of them were married, 91% were males, 31% had a college degree, 47% were rotating-shift workers, and 80% were employed through contracts. Their average work experience was 17.27±15.4 years. The values of Cronbach's Alpha were acceptable in the study groups (Table 2).

The results of One-way ANOVA test are presented in Table 3. As seen, the study groups differed significantly in the mean score of the safety climate' underlying dimensions (P=0.001). The results also indicated that almost in most dimensions, mining and ceramic industry workers perceived the lowest and highest levels of safety climate, respectively. The highest and lowest safety climate mean scores of management safety commitment and empowerment dimension belonged to ceramic (3.156) and mine (2.543) industries, respectively. The highest and lowest safety climate mean scores of the workers' safety commitment dimension belonged to agriculture (3.312) and mine (2.290) industries. The highest and lowest safety climate mean scores of workers' safety priority dimension belonged to ceramic (3.233) and mine (2.241) industries, respectively. Steel industry workers 3.002() and hospital staff (2.573) had the best and worst perceptions of safety climate for workers' safety participation and communication dimension, respectively. Ceramic workers (3.196) and miners (2.475) reported the best and worst perceived safety climates at workers' risk non-acceptance dimension, respectively.

The results of Tukey (POST-HOC) test are presented in Table 4. This Table indicates significant differences in safety climate dimension scores across the groups (P≤0.05).

Table 1: Some demographic characteristics of the respondents (n=404)

Age (year) Median		29
Work Experience (year) Median		9
Marital Status No. (Percent)	Single N (%)	134(33.16%)
	Married N (%)	270(66.84%)
Gender No. (Percent)	Male N (%)	361(90.9%)
	Female N (%)	43(9.19%)
Education No. (Percent)	Under Diploma N (%)	106(28.9%)
	Diploma and higher N (%)	298(71.1%)
Shift Schedule No. (Percent)	Day N (%)	163(41 %)
	Night N (%)	241(59%)
Type of employment No.(percent)	Permanent N (%)	70(19%)
	Contractual N (%)	334(81%)

Table 2: Comparison of the reliability of Persian version of NOSCQ among study groups (n=404)

Industries		Number of acceptable questionnaire	Cronbach's alpha
Hospital		59	0.936
Steel industries	500> workers	100	0.655
	50-500 workers	45	0.913
	20-50 workers	32	0.935
	<20 workers	14	0.834
Ceramic industry		85	0.924
Agricultural section		41	0.931
Mining industry		30	0.944

Table 3: Comparison of safety climate score among the studied enterprises (n=404)

Safety climate dimensions	Agriculture	Hospital	Steel industry				Ceramic industry	Mining industry	F factor	P value**
			500> workers	50-500 workers	20-50 workers	<20 workers				
Management safety commitment and empowerment	3.046	2.869	2.548	2.567	2.715	2.581	3.156	2.543	22.303	0.000*
Workers' safety commitment	3.312	3.023	2.810	3.074	3.109	2.809	3.306	2.762	9.206	.000*
Workers 'attitude toward safety	3.331	3.194	3.102	3.111	3.140	2.750	3.259	2.290	10.101	0.000*
Workers' safety priority	2.625	2.669	2.698	2.829	2.541	2.738	3.233	2.241	12.184	0.000*
Workers 'safety participation communication	2.964	2.573	2.822	3.002	2.671	2.828	2.994	2.584	6.487	0.000*
Workers' risk non-acceptance	3.100	2.623	2.715	2.790	2.578	2.851	3.242	2.433	9.942	0.000*
Total	3.063	2.825	2.782	2.895	2.792	2.759	3.198	2.475	18.248	0.000*

*Difference is significant (P>0.05); **OnewayAnova Test

The investigation of the association between safety climate level and variables such as gender, marital status, managerial job experience and history of workplace accident showed that male and female workers differed significantly only at the workers' safety participation and communication (P<0.001) and no significant difference was observed in other dimensions.

The results of Kruscal-Wallis test (investigating the association between safety climate level and variables such as educational level, type of employment and work shift) indicated a significant association between the total mean score of safety climate perception and variables such as educational level and work shift (P<005) (Table 5); however, the type of employment did not have any relationship with safety climate dimensions.

The results of Mann-Whitney test (investigating the association between safety climate mean score and variables such as educational level, type of employment and work shift) showed a significant difference in the safety climate mean score between people with high school degrees and those with elementary education (P=0.05) or secondary-level education (P=0.001), and also between people with higher education and those with secondary-level education (P=0.001) or

Table 4: The results of the comparison of total safety climate scores among industries (n=404)

I	J	Mean differences	P value	I	J	Mean differences	P value**
Agriculture	Hospital	0.23756*	0.028*	Hospital	Agriculture	0.16731	0.377
	Steel company (500> workers)	0.28032*	0.001*		Steel company(500> workers)	0.04276	0.996
	Steel company (50-500 workers)	0.16731	0.377		Steel company (50-500 workers)	-0.07025	0.975
	Steel company (20-50 workers)	0.27031*	0.032*		Steel company (20-50 workers)	0.03276	1.000
	Steel company (<20 workers)workers	0.30346	0.113		Steel company (<20 workers) workers	0.06590	0.999
	Ceramic industry	-0.13532	0.495		Ceramic industry	-0.37288*	0.000*
	Mining industry	0.58736*	0.000*		Mining industry	0.34980*	0.001*
Steel company ((500> workers)	Agriculture	0.28032*	0.001*	Steel company (50-500 workers)	Agriculture	0.16731	0.377
	Hospital	0.04276	0.996		Hospital	-0.07025	0.975
	Steel company(50-500 workers)	0.01000	1.000		Steel company(500> workers)	0.11301	0.640
	Steel company (20-50 workers)	0.11301	0.640		Steel company(20-50 workers)	0.10300	0.916
	Steel company(<20 workers)	-0.02314	1.000		Steel company (<20 workers)	0.13615	0.916
	Ceramic industry	0.41564*	0.000*		Ceramic industry	-0.302*	0.000*
	Mining industry	-0.30704*	0.001*		Mining industry	0.42005*	0.000*
Steel company(20-50 workers)	Agriculture	0.27031*	0.032*	Steel company (< 20 workers)	Agriculture	0.30346	0.113
	Hospital	0.03276	1.000		Hospital	0.06590	0.999
	Steel company(500> workers)	0.01000	1.000		Steel company(500> workers)	-0.02314	1.000
	Steel company (50-500 workers)	0.10300	0.916		Steel company (50-500 workers)	0.13615	0.916
	Steel company (<20 workers)	-0.03314	1.000		Steel company (20-50 workers)	-0.03314	1.000
	Ceramic industry	-0.40564*	0.000*		Ceramic industry	-0.43878*	0.001*
	Mining industry	0.31705*	0.013*		Mining industry	0.28391	0.221
Ceramic industry	Agriculture	-0.13532	0.495	Mining industry	Agriculture	0.58736*	0.000*
	Hospital	-0.37288*	0.000*		Hospital	0.34980*	0.001*
	Steel company(500> workers)	0.41564*	0.000*		Steel company(500> workers)	-0.30704*	0.001*
	Steel company(50-500 workers)	-0.302*	0.000*		Steel company (50-500 workers)	0.42005*	0.000*
	Steel company (20-50 workers)	-0.40564*	0.000*		Steel company (20-50 workers)	0.42005*	0.000*
	Steel company (<20 workers)	-0.43878*	0.001*		Steel company(<20 workers)	0.283910	0.221
	Mining industry	0.72268*	0.000*		Ceramic industry	0.72268*	0.000*

*The difference is statistically significant; **Post Hoc Test

Table 5: Association between safety climate mean scores with employees' educational level, type of employment and work shift (n=404)**

Variables		Educational level	Type of employment	Work shift
Management safety commitment and empowerment	Chi-Square	34.124	3.414	7.897
	Asymp. Sig.	0.000*	0.332	0.048*
Workers' safety commitment	Chi-Square	8.792	1.392	2.306
	Asymp. Sig.	0.067	0.707	0.511
Workers 'attitude toward safety	Chi-Square	14.180	2.854	16.075
	Asymp. Sig.	0.007*	0.415	0.001*
Workers' safety priority	Chi-Square	34.003	8.261	18.981
	Asymp. Sig.	0.000*	0.041*	0.000*
Workers 'safety participation and communication	Chi-Square	12.998	3.904	0.840
	Asymp. Sig.	0.011*	0.272	0.840
workers' risk non-acceptance	Chi-Square	16.479	3.470	3.226
	Asymp. Sig.	0.002*	0.325	0.358
Total	Chi-Square	26.702	4.997	9.205
	Asymp. Sig.	0.000*	0.172	0.027*

*The difference is statistically significant; **Kruscal Wallis Test

elementary education (P=0.001). Additionally, with respect to the association between work shift and safety climate perception, there was a significant difference between day-shift and rotating shift workers in the total mean score of safety climate perception (P=0.08).

The results of investigation on the association between safety climate level and variables such as the presence of Safety Management System and Occupational Health and Safety department displayed in Table 6 indicated a significant association between all dimensions of safety climate and the existence of OH&S department (P=0.001); however, this association was not seen in the workers' risk non-acceptance (P=0.079).

The association between safety climate level and variables of age and work experience was significant, as

Table 6: Association between the level of safety climate and implementation of safety management system and existence of occupational health and safety department*

Dimensions	Variables	Presence of Safety Management System		Presence of OHS Department	
		Yes	No	Yes	No
Management safety commitment and empowerment	Mean	3.12	2.75	3	2.62
	Min-Max	0-4	0-19	3-0	0-0
	P value	0.001*		0.001*	
Workers' safety commitment	Mean	3.2	2.8	3	2.4
	Min-Max	1.6-4	1.6-5.23	1.6-5.33	1.8-3.2
	P value	0.001*		0.001*	
Workers 'attitude toward safety	Mean	3	2.71	2.85	2.42
	Min-Max	1-4	1.57-6	1-6	1.8-3.3
	P value	0.001*		0.001*	
Workers' safety priority	Mean	3.2	2.75	3	2.5
	Min-Max	1.7-4	0-4.3	0-4.3	1.7-3.2
	P value	0.001*		0.001*	
Workers' safety participation and communication	Mean	3	2.81	2.83	2.66
	Min-Max	1.5-4	1.5-6.3	1.5-6.3	2-3.2
	P value	0.001*		0.001*	
Workers' risk non-acceptance	Mean	2.87	2.75	2.75	2.62
	Min-Max	1.4-4.3	1.7-3.7	1.4-4.3	1.9-3
	P value	0.001*		0.001*	
Total	Mean	2.99	2.68	2.87	2.49
	Min-Max	1.9-3.8	2.2-5.5	1.9-5.5	2.2-2.9
	P value	0.001*		0.001*	

*The difference is statistically significant

Table 7: The result of Pearson correlation between the level of safety climate and employees' age and work experience

Variables / Dimensions	Age		Work experience	
	r	P value	r	P value
Management safety commitment and empowerment	-0.147	0.005*	0.259	0.000*
Workers' safety commitment	-0.080	0.124	0.178	0.001*
Workers 'attitude toward safety	-0.023	0.655	0.064	0.230
Workers' safety priority	-0.126	0.015*	0.024*	0.647
Workers 'safety participation and communication	-0.127	0.015*	0.020*	0.707
Workers' risk non-acceptance	-0.139	0.007*	0.082	0.123
Total	-0.147	0.005*	0.150	0.005*

*The correlation is statistically significant

presented in Table 7 (P=0.05). This association was also significant in all dimensions of safety climate and these two variables excluding the association between age and workers' safety commitment and workers' attitude toward safety (P>0.05). The association between safety climate perception and management safety commitment and empowerment was also significant (P=0.05).

The regression analysis between safety climate level and all variables showed that there were significant associations between the safety climate and some variables such as age, education level and work experience (P=0.05) (Table 8).

Discussion

The present study evaluated the factors affecting the safety climate in 8 business enterprises. .Safety climate dimensions scores differed in the study groups and the highest total mean of safety climate was observed in ceramic industry (3.19). It was shown that ceramic workers perceived the best safety climate among the study groups. This could be attributed to the fact that in the studied ceramic industry there was OH&S department, and Safety Management Systems of OHSAS 18001 had been established. Moreover, employees of this industry were well aware of the concepts of safety and risk, so they tried to do their tasks in a safe way.

The lowest total mean of safety climate perception was observed in mine industry (2.47). Therefore, miner's perceived the best safety climate among the study groups.

Contrary to ceramic industry, there was no OH&S department in the mine industry and no training courses had been held for the staff. Moreover, they were not aware of the concepts of safety and risk and believed that safety management was not considered as a workplace priority. Olsen and Aase concluded

Table 8: The result of regression analysis between the level of safety climate and all variables

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	P value	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.030	0.300		10.108	0.000	2.440	3.621
	Age	-0.010	0.005	-0.136	-2.137	0.033	-0.020	-0.001
	Sex	-0.176	0.103	-0.095	-1.698	0.090	-0.379	0.028
	education	0.094	0.027	0.211	3.436	0.001	0.040	0.148
	Work experience	0.005	0.002	0.211	2.707	0.007	0.001	0.009
	Marriage status	0.072	0.050	0.089	1.450	0.148	-0.026	0.171
	Managerial job	0.005	0.049	0.006	0.100	0.920	-0.092	0.101
	Accident experience	0.009	0.047	0.010	0.182	0.856	-0.085	0.102
	Shift work	0.020	0.015	0.079	1.331	0.184	-0.010	0.050
	Employment type	-0.092	0.053	-0.105	-1.736	0.084	-0.197	0.012

a. Dependent Variable: total mean

that safety climate in oil industry was better than that of hospitals.[7] The rate of workplace accidents and injuries in oil industry was lower than that in hospitals due to the existence of efficient safety systems in oil industry. Therefore, the existence of management systems, OH&S department and continuous training for the employees effectively promoted the safety climate within organizations and industries.

Although most studies on safety climate have not investigated the effect of plant size and the number of employees on safety climate,[10-13] the results of this study showed no association between the plant size and level of safety climate because in this study safety climate level in the steel company with more than 500 workers was lower than that in the rest of the steel industries. It seems that the existence of safety and health management systems as well as OH&S department makes the difference in safety climate among the groups. As the results showed safety climate level was significantly associated with the existence of safety and health management systems as well as professional health and safety units (P=0.001).

No association was found between the safety climate level and marital status. The results are in the same line with the study conducted by KUDO[14] on Japan hospitals which indicated no difference in the safety climate level between single and married nurses.

This study also revealed that managerial job experience did not affect the safety climate level and there was no difference in the safety climate perception between employees with managerial job experience and those without it. Although the result of this study is in line with those of Vosoughi,[15] who demonstrated that the nature of work had no effect on safety climate level, Abdullaha[16] showed the existence of association between the safety climate level and nature of work in Malaysian hospitals.

Consistent with the studies conducted by Vinodkumar[4] and Yeung,[17] this research revealed that safety climate perception was not associated with gender and accident history.

This study also indicated that safety climate perception was significantly associated with the employees' educational level and work shift, so that safety climate score increased with increase in the educational level. Vinodkumar and Andersen[4] also suggested that there was an association between educational level and safety climate. Therefore, the more educated the employees are, the more safety climate perception they may have in their workplaces.

Although a significant association was not found between the type of employment and total mean of safety climate, a significant difference in workers' safety priority was observed between permanent and contractual employees. In other words, a significant difference was found in the safety climate level between permanent employees and other types of employees. It shows that permanent employees give more priority to safety issues compared to other employees. Adl[18] also showed a difference in the safety climate level and attitude between permanent and employees on contract in steel industry. Therefore, permanent employees obtained higher scores in safety attitude compared to other groups of employees.

The results showed a significant difference in the total mean score of safety attitude between day-shift and night-shift workers as well as between rotating-shift workers and night-shift ones (P=0.001). In other words, shift work affects the safety climate level. This is consistent with the study of Bergh[19] who investigated the association between shift work and safety climate level.

Safety climate level was significantly associated with age and job experience. Heidari and Vinodkumar[4, 20] concluded that safety climate level increased with increase in age and work history. However, the present study indicated an inverse significant correlation between the safety climate level and employees' age, while it increases with increase in job experience. Despite the results of these studies, the correlation between safety climate and job experience was not found in the study of Vosoughi et al.

The results also revealed that there were significant associations between the safety climate level and variables such as age, educational level and work experiences. Although we have not found any similar study to examine these variables and safety climate, this pattern shows that as the person becomes highly educated, it is more likely to accept the safety concepts and then she or he will do the work according to the safety principles.

Conclusion

This study evaluated the level of safety climate among 8 business enterprises. The highest and lowest levels of safety climate were observed in ceramic and mine industries, respectively. Plant size and the number of workers had no effect on the safety climate. The difference in the safety climate level among the groups with different plant sizes was due to the existence of health and safety management systems as well as OH&S departments in the plants.

A more comprehensive study is required to examine the association between workplace accidents and safety climate level. The authors also suggest a research on the employees' type of employment and selecting equal same sizes to specify the association between the safety climate level and type of employment.

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