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An investigation of safety climate in OHSAS 18001-certified and non-certified organizations

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Many organizations worldwide have implemented Occupational Health and Safety Assessment Series (OHSAS) 18001 in their premises because of the assumed positive effects of this standard on safety. Few studies have analyzed the effect of the safety climate in OHSAS 18001-certified organizations. This case–control study used a new safety climate questionnaire to evaluate three OHSAS 18001-certified and three non-certified manufacturing companies in Iran. Hierarchical regression indicated that the safety climate was influenced by OHSAS implementation and by safety training. Employees who received safety training had better perceptions of the safety climate and its dimensions than other respondents within the certified companies. This study found that the implementation of OHSAS 18001 does not guarantee improvement of the safety climate. This study also emphasizes the need for high-quality safety training for employees of the certified companies to improve the safety climate.

Keywords: occupational health and safety management system; OHSAS implementation; safety climate; safety training; manufacturing

1. Introduction

Many organizations have implemented occupational health and safety management systems (OHSMSs) for the effective management of occupational health and safety (OHS).[1–4] The number of such enterprises has increased worldwide, especially after the publication of Occupational Health and Safety Assessment Series (OHSAS) 18001.[5] This important modification in OHS management resulted in the reduction of occupational injuries, and increased the level of the safety climate in the workplace.[6] Only a few studies have investigated any changes in the safety climate in OHSAS 18001-certified companies, as far as the author is aware.[7] Some existing safety climate studies mainly focused on the design of measurement scales and the determination of safety climate dimensions.[8–13] Other studies tried to determine the relationship between the safety climate and safety performance in enterprises.[14–16]

Several studies have investigated the development of safety climate scales in different industries after the safety climate concept was introduced by Zohar in 1980.[13] These studies found that the core dimensions of the safety climate include management commitment to safety, safety systems (e.g., training, compliance and communication), risk, competence, work pressure, procedures and rules.[17] Management commitment and employee involvement were found to be the most important dimensions.[17–19] Other frequently used dimensions included safety communication and safety training, as well as supportive and supervisory environments.[8,11] There is still no consensus, however, regarding safety climate dimensions among researchers.

Researchers have investigated the influence of organizational factors such as the safety culture and climate on the performance of safety in recent decades.[20–22] They declared that the safety climate is distinct from the safety culture, and it is a more preferred measure to assess the safety performance in an organization.[11] The safety climate is considered to be a constituent or superficial characteristic of the safety culture.[23–25] The term ‘safety climate’ is defined as employees’ shared perceptions about the safety management of an organization.[23–25] It is typically measured using a questionnaire that is designed to ask questions of active employees in an organization about their respective top managers’ commitment to safety.[24,26,27] However, the safety culture is a deeper phenomenon that reflects an organization’s values, norms, beliefs, expectations and assumptions regarding safety.[17,24,28]. The safety culture is measured by qualitative methods such as performing interviews with employees and carrying out safety audits.[24] Evaluation of the safety culture needs more time than the evaluation of the safety climate: it is also difficult to conduct.

A large number of researchers have studied the association between the safety climate and safety performance in various industries.[10,13,29–31] Interest in this topic has especially increased after the introduction of safety

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management systems to study the role of the safety climate in the prevention of occupational accidents or injuries.[9] A majority of studies found that the level of the safety climate is negatively correlated with accident rates.[10,29,31–33] Other researchers used safety climate scores to predict safety outcomes such as accident/injury rates and safety behavior.[34, 35]

Earlier studies suggest that the safety climate is linked to organizational and individual factors in various industries. O'Toole indicated that the implementation of organizational safety interventions resulted in changes in the safety climate.[36] Ma and Yuan claimed that the improvement of workplace safety in any type of industry depends on the safety climate.[10] DeJoy et al. demonstrated that adopting the elements of a safety management system such as safety policies and programs, communication and organizational support enhance the safety climate.[26] Fernández-Muñiz et al. suggested that it is necessary for OHSAS 18001-certified companies to have a satisfactory level of safety climate in their workplaces to achieve the goal of zero accidents.[7] They also emphasized the importance of communication and management commitment. Vinodkumar and Bhasi found that OHSAS 18001-certified organizations had the highest level of safety management practices compared with organizations with ISO 9001 or with those that had no management system certifications at all.[37] A review of 13 empirical OHSMS studies by Robson et al. revealed that the safety climate improvement was evidence for the effectiveness of the voluntary OHSMS interventions. However, those authors did not find enough evidence in their review to make a clear conclusion for or against the implementation of voluntary or mandatory OHSMSs.[6] These studies generally suggest that a positive safety climate is an important organizational asset and it can influence the safety performance of an organization.

There are other studies that examined the relationship between both occupational and organizational factors and related these to the safety climate. Several studies have found differences in the safety climate among organizations,[13,38] among different groups of employees,[17,27,39–41] and among dissimilar jobs.[39,42,43] Individual factors such as job tenure, job positions and safety training have a significant impact on safety climate.[41,43] Gyekye and Salminen also found a positive association between the educational level of employees and their perceptions about the safety climate.[44]

The aim of all OHSMSs such as OHSAS 18001 *inter alia* is to make improvements in the safety performance of the companies that implement their respective standards or guidelines. Therefore, it is expected that employees who work in OHSAS 18001-certified companies have better perceptions of the safety climate than employees who work in non-certified companies. Assessment of safety literature shows that there are few studies on the topic of the safety climate in Iran, and there is no study that has determined the influence of the safety climate in OHSAS 18001-certified companies. The purpose of this study was to compare the levels of the safety climate between OHSAS 18001-certified and non-certified organizations and to investigate the variables that predict the safety climate level in Iran.

2. Methods

This study used a cross-sectional design and used a questionnaire for gathering data, which was sent to employees in 2011. A total of 269 employees from six manufacturing companies based in the West Azerbaijan province in Iran participated in this study. The nature of the studied companies was such that only a few of the participants ($n = 6$) were female, and they were thus excluded from the analysis leaving 263 respondents. The case companies consisted of three manufacturing facilities that had implemented the requirements of the OHSAS 18001 standard and were certified by a certification body. The remaining three companies had not implemented OHSAS 18001 in their sites and they served as controls. The companies were producers of beverages, chemical, electrical products and the goods used in construction and agriculture. A detailed presentation of the companies and certification year can be found in Ghahramani and Summala.[46]

The study questionnaire consisted of questions on demographic data, experience of accidents, participation in safety training courses and the safety climate scale, including seven dimensions (Table 1). The development, validity and reliability analysis of the scale used in this study are detailed in another manuscript (under review). All 45 safety climate items were rated on a 5-point Likert-type scale with the verbal responses of 1 = *strongly disagree*, 2 = *disagree*, 3 = *neutral*, 4 = *agree* and 5 = *strongly agree*.

Descriptive statistics were obtained on the studied variables at first. A *t* test was used to evaluate the relationship between safety climate and occupational accident experience in addition to participation in safety training courses. A one-way analysis of variance (ANOVA) was used to test the relationship between the safety climate dimensions and demographic variables, occupational groups and companies. Hierarchical regression was used to examine the ability of independent variables including OHSAS implementation to predict the safety climate. All statistical analyses were conducted using SPSS version 22.

3. Results

The demographic, personal and occupational characteristics of the participants are presented in Table 2. The majority of the respondents were married (92.8%). The mean age of the respondents was 37.63 (*SD* 7.01) years, and their mean working experience was 13.51 (*SD* 6.44) years. About half of the participants (49%) had received

Table 1. Safety climate scale dimensions and items

Safety commitment and communication	
1	Workers were given sufficient feedback regarding safety proposals
2	In my workplace managers/supervisors show interest in safety issues
3	Workers were able to openly discuss safety problems with supervisors or managers
4	Management allocated sufficient resources to health and safety
5	People who work safely are respected by their managers/workmates
6	Management looked for underlying factors that contributed to safety incidents rather than blame the people involved
7	Management acts decisively and quickly when a safety concern is raised
8	The company shows interest in my views on health and safety
9	I always get the equipment I need to do the job safely
10	Changes in working procedures and environment and their effects on safety are effectively communicated to workers
11	The company really cares about the health and safety of the people who work here
12	Safety and health information (outcome of OHS meetings, causes of accidents/incidents, etc.) is effectively disseminated to all appropriate personnel
13	Workers were consulted about health and safety issues
14	On my unit, senior-level management gets personally involved in safety activities
15	I can influence health and safety performance here
16	Management had a good understanding of operational issues that impacted on work safety
Safety involvement and training	
1	I get involved when health and safety procedures/instructions/rules are developed or reviewed
2	I received related training when new procedures or equipment were introduced
3	I am strongly encouraged to report unsafe conditions
4	People here are consulted to establish their training needs
5	Safety training was received at regular intervals to refresh and update knowledge
6	The company encourages suggestions on how to improve health and safety
7	Company training provided adequate skills and experience to carry out operations safely
8	Accident investigations aim at finding causes of accidents rather than blaming individuals
Positive safety practices	
1	There are always enough people available to get the job done safely
2	I generally feel challenged and motivated by my work tasks
3	My work site is often safe
4	My workload is reasonably balanced
5	The company would stop us working because of safety concerns, even if it meant losing money
6	I receive appropriate feedback about my performance
7	The regulatory requirements on health and safety are performed in my workplace
8	My supervisor always has control over safety rule violations
Safety competency	
1	I am clear about what my responsibilities are for health and safety
2	I fully understand the health and safety risks associated with the work for which I am responsible
3	I fully understand the health and safety procedures/instructions/rules associated with my job
Safety procedures	
1	Some health and safety procedures/instructions/rules need to be followed to get the job done safely
2	Safety is the number one priority in my mind when completing a job
3	Most of the health and safety procedures/instructions/rules reflect how the job is now done
4	Procedures are written in clear unambiguous language appropriate to the needs of the user
Accountability and responsibility	
1	My workmates would react strongly against people who break health and safety procedures/instructions/rules
2	The written safety rules and instructions are easy for people to understand and implement
3	Co-workers often give tips to each other on how to work safely
Supportive environment	
1	In my company, safety considerations are equally as important as production
2	The rules always describe the safest way of working
3	Safety information is always brought to my attention by my line manager/supervisor

Note: OHS = occupational health and safety.

upper secondary education. The mean job tenure (years of experience in current job) of the participants was 10.40 (*SD* 6.58). The majority of the participants (57%) were involved in production.

Nearly one-quarter (22.8%) of the respondents reported that they had experienced at least one occupational accident within the past 3 years. However, the level of safety climate did not differ between these individuals and the respondents who had no accidents ($t(261) = 0.89$, $p > .05$). The numbers of employees who experienced accidents in the case companies ($n = 43$, 26.54%) were higher than for the control companies ($n = 17$, 16.83%). The participants who worked for the certified companies and who experienced occupational accidents had a better perception of accountability and responsibility ($t(160) = 2.18$, $p < .05$) than other respondents.

The results showed that 138 (52.5%) employees participated in safety training courses. Further, the number of employees who received safety training in the certified companies was greater than in the control companies (60%/40%). Employees who received safety training had a better perception of the safety climate than those who did not receive safety training ($t(261) = 4.29$, $p < .01$). Safety climate dimensions also significantly differed between the two groups. Respondents who worked in the certified companies and received safety training reported a higher level of the safety climate ($t(160) = 4.40$, $p < .01$) and all safety climate dimensions than respondents who had not received safety training. However, safety involvement and training ($t(99) = 2.29$, $p < .05$) was the only significantly affected dimension reported by employees of the control companies who had received safety training (Table 3).

The results of one-way ANOVA showed that respondents differ significantly in accountability and responsibility ($F(3, 259) = 3.32$, $p < .05$) and supportive environment ($F(3, 259) = 5.10$, $p < .01$) with respect to education. There were statistically significant differences in the safety climate between educational groups in the certified companies ($F(3, 158) = 3.31$, $p < .05$) and three out of seven safety climate dimensions were statistically different. There were also statistically significant differences in the

Table 2. Demographic, personal and occupational characteristics of the 263 respondents.

	Certified	Non-certified	Total
Variable	*N* (%)	*N* (%)	*N* (%)
Marital status			
Married	153 (94.4)	91 (90.1)	244 (92.8)
Single	9 (5.6)	10 (9.9)	19 (7.2)
Age groups (years)			
< 30	24 (14.8)	32 (31.7)	56 (21.3)
30–39	56 (34.6)	42 (41.6)	98 (37.3)
40–49	72 (44.4)	25 (24.8)	97 (36.9)
50–59	10 (6.2)	2 (2.0)	12 (4.6)
≥ 60	–	–	–
Working experience (years)			
< 1	1 (0.6)	1 (1.0)	2 (0.8)
1–5	11 (6.8)	22 (21.8)	33 (12.5)
6 –10	28 (17.3)	28 (27.7)	56 (21.3)
11–15	51 (31.5)	28 (27.7)	79 (30.0)
16–20	42 (25.9)	12 (11.9)	54 (20.5)
> 20	29 (17.9)	10 (9.9)	39 (14.8)
Education			
Primary	9 (5.6)	3 (3.0)	12 (4.6)
Lower secondary	23 (14.2)	9 (8.9)	32 (12.2)
Upper secondary	68 (42.0)	61 (60.4)	129 (49.0)
Tertiary	62 (38.3)	28 (27.7)	90 (34.2)
Nature of job			
Production	72 (44.4)	78 (77.2)	150 (57)
Maintenance	57 (35.2)	12 (11.9)	69 (26.3)
Office	33 (20.4)	11 (10.9)	44 (16.7)
Job tenure (years)			
< 1	8 (4.9)	7 (6.9)	15 (5.7)
1–5	32 (19.8)	36 (35.6)	68 (25.9)
6–10	33 (20.4)	20 (19.8)	53 (20.2)
11–15	45 (27.8)	25 (24.8)	70 (26.6)
16–20	26 (16.0)	6 (5.9)	32 (12.2)
> 20	18 (11.1)	7 (6.9)	25 (9.5)

Table 3. Associations among safety climate dimensions with safety training (*t* test) and education (analysis of variance).

	Certified				Non-certified			
	1	2		3	1	2		3
Participants who received training	48	33		16	15	20	6	
Participants who did not receive training	16	16		33	16	15	29	
Safety climate dimensions	*M*	*SD*	*t*(160)	*F*(3, 158)	*M*	*SD*	*t*(99)	*F*(3, 96)
Safety commitment and communication	3.37	0.71	3.97**	4.17**	3.28	0.92	1.28	4.14**
Safety involvement and training	3.01	0.81	4.15**	1.99	2.85	0.85	2.29*	2.72*
Positive safety practices	3.24	0.77	2.49*	2.49	3.27	0.84	1.75	4.73**
Safety competency	3.69	0.98	4.24**	1.30	3.65	1.00	1.31	3.72**
Safety procedures	3.76	0.71	3.16**	2.64	3.74	0.83	0.47	5.35**
Accountability and responsibility	3.38	0.78	2.82**	3.02*	3.40	0.87	–0.15	6.56**
Supportive environment	3.07	0.87	2.88**	7.08**	3.28	0.98	0.96	3.68*

*$p < .05$; **$p < .01$.

safety climate between the participants of the control companies ($F(3, 96) = 6.10$, $p < .01$) and all safety climate dimensions were also different. The mean and standard deviation of the safety climate dimensions in the case and the control companies are presented in Table 3.

The safety climate varied significantly among the occupational groups ($F(2, 260) = 3.43$, $p < .05$). The findings also showed that the occupational groups perceived different levels of the following safety climate dimensions: safety commitment and communication ($F(2, 260) = 3.93$, $p < .05$), safety involvement and training ($F(2, 260) = 3.67$, $p < .05$) and positive safety practices ($F(2, 260) = 4.57$, $p < .05$). In the certified companies, occupational groups differed significantly in the safety climate ($F(2, 159) = 5.65$, $p < .01$), safety commitment and communication ($F(2, 159) = 6.58$, $p < .01$), safety involvement and training ($F(2, 159) = 7.67$, $p < .01$) and positive safety practices ($F(2, 159) = 6.01$, $p < .01$).

The personnel of the studied companies also differed significantly in their perceptions of the safety climate ($F(5, 257) = 13.30$, $p < .01$), and Tukey's post hoc comparisons revealed that the participants in one non-certified company (Non-certified 2) reported a higher level of safety climate (3.77 [*SD* 0.45], $p < .01$) than other companies. The safety climate of the certified companies varied ($F(2, 159) = 7.76$, $p < .01$) and five out of seven safety climate

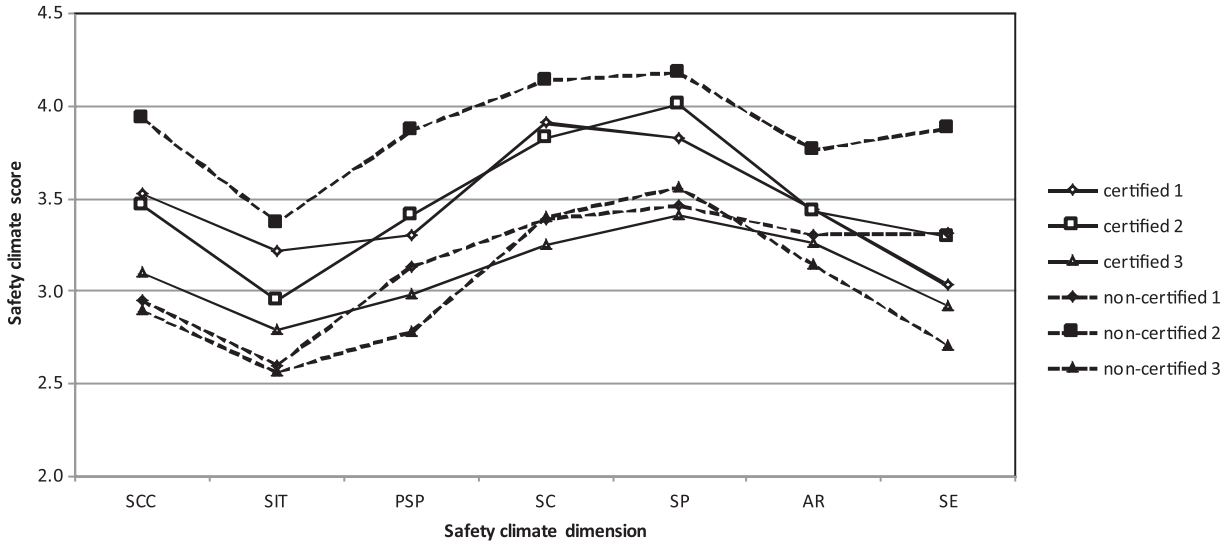

Figure 1. Safety climate scores of certified and non-certified companies.
Note: SCC = safety commitment and communication; SIT = safety involvement and training; PSP = positive safety practices; SC = safety competency; SP = safety procedures; AR = accountability and responsibility; SE = supportive environment.

Table 4. Hierarchical linear regression for safety climate.

	Total ($N = 263$)		Certified ($n = 162$)		Non-certified ($n = 101$)	
Independent variable	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
OHSAS implementation	0.05	− 0.29**	–	–	–	–
Accident experience	− 0.06	− 0.01	− 0.11	− 0.10	0.02	0.11
Safety training	− 0.26**	− 0.15*	− 0.33**	− 0.26**	− 0.18	− 0.02
Company	–	–	–	–	–	–
Certified 1	–	0.00	–	0.00	–	–
Certified 2	–	0.01	–	0.01	–	–
Certified 3	–	0.19**	–	0.20*	–	–
Non-certified 1	–	s − 0.05	–	–	–	0.53**
Non-certified 2	–	− 0.45**	–	–	–	0.00
Non-certified 3	–	0.00	–	–	–	0.63**
R^2	0.07	0.23	0.12	0.15	0.03	0.35
F	6.62	10.55	10.95	7.15	1.56	13.01
p	0.001	0.001	0.001	0.001	0.21	0.001

*$p < .05$; **$p < .01$.
Note: Table shows standardized regression coefficients (β); – = data were not obtained in model 1 or the analyses were not applied for the variables; OHSAS = Occupational Health and Safety Assessment Series.

dimensions were also different. Tukey's post hoc comparisons demonstrated that the certified companies statistically varied from each other in the safety climate, safety competency and safety procedures. The control companies also differed significantly in the safety climate ($F(2, 97) = 25.27$, $p < .01$) and all of the safety climate dimensions. Figure 1 shows the mean of the safety climate dimensions for the case companies and their non-certified controls.

The present study collected multilevel data, i.e., at the employees' level (level 1) and the companies' level (level 2). We therefore conducted a preliminary analysis using hierarchical linear modeling (HLM 7: student version) to assess the appropriateness of data for multilevel analysis. The result indicated that the value of intra-class correlation (ICC = 0.24) is acceptable.[45] However, the multivariate model was not significant ($F(4, 1) = 116.52$, $p = .07$). We thus continued the statistical analysis using hierarchical regression.

A two-step hierarchical regression was conducted to determine the predictors of safety climate. In step 1, OHSAS implementation, occupational accident experience and participation in safety training courses were entered. This model was statistically significant ($F(3, 259) = 6.62$, $p < .01$) and participation in safety training was a significant predictor. The entry of organization dummies in step 2 resulted in a significant model ($F(7, 255) = 10.55$, $p < .01$), and in addition OHSAS implementation and training were significant predictors. Two separate hierarchical regressions were performed to ascertain the ability of independent variables in the prediction of safety climate in the case and the control companies. The safety training was related to the safety climate for the case companies (Table 4). The variance inflation factors (VIF) values of independent variables were fewer than the acceptable level of 10,[37] which indicated that the multi-colinearity level was not high.

4. Discussion

The main objective of the present study was to examine the determinants of safety climate in OHSAS 18001-certified companies by comparison with those of the control companies. Hierarchical regression revealed that the OHSAS implementation was a significant predictor of safety climate, which is a finding in agreement with that reported in the systematic review by Robson et al. [6] Participation in safety training courses was found to be another significant predictor of safety climate, which suggests that this has an important role in the improvement of the safety climate of certified organizations. This finding agrees with the results of two previous studies that found a significant relationship between safety climate and safety training.[10,41,43]

A descending order of the mean scores of safety climate dimensions were ranked as follows: safety procedures (3.75), safety competency (3.67), accountability and responsibility (3.39), safety commitment and communication (3.34), positive safety practices (3.25) and supportive environment (3.16), in addition to safety involvement and training (2.95). A separate analysis showed that the certified companies reported a higher level of safety commitment and communication, safety involvement and training, safety competency and safety procedures than for the control companies (Table 3). The results also showed that the number of employees who received safety training in the certified companies was greater than for the control companies. These findings strongly indicate that receiving safety training is an important factor which increases the employees' perceptions about safety climate in the certified companies. In addition, the highest values of safety climate in the second control company may associate with the high level of safety training activity (57%) for the same company.

The existence of significant differences in safety climate and its dimensions across the companies is in agreement with the findings of earlier studies.[13,16,38] The participants of one of the control companies reported the highest level of safety climate perception. The *t*-test analysis did not find a significant difference in the perceptions of personnel about safety climate between the case and the control companies ($t(261) = 0.08$, $p > .05$). These findings suggest that the implementation of OHSAS 18001 cannot guarantee the improvement of safety climate. The present study also found a significant association between occupational groups and safety climate. The latter finding is supported by those of other groups, namely Glendon and Litherland,[39] Findley et al.[42] and Wu et al.[43]

Wu et al. indicated in an earlier study that the perception of safety climate differed between employees who had not experienced accidents from those employees who had.[43] This present study, however, did not find a significant difference after making a similar comparison. This discrepancy between these two studies might be because the participants who experienced accidents in the present study did not learn sufficiently from the accidents, and thus the events could not affect their perception about safety. This may also relate to the low severity of injuries sustained, with the slightly injured employees assuming this kind of event to be a routine outcome of their jobs.

This study examined the safety climate in three OHSAS 18001-certified manufacturing companies in the West Azerbaijan province and their corresponding control companies. The findings of this study may only be specific for manufacturing companies in the West Azerbaijan province because of the existence of a limited number of certified manufacturing companies there. The study objective was to assess the effect of the implementation of OHSAS 18001 on improvement of the safety climate, and thus it is necessary to conduct further studies about the influence of the organizations' practices on other safety performance indicators in order to establish the overall effectiveness of the

implemented system. A limitation of this study was that the required data for the purpose of analysis were derived from a cross-sectional survey. The self-reporting of measures is another limitation, and may cause some concern that there is a potential for bias.

5. Conclusion

This study demonstrated that the implementation of OHSAS 18001 and safety training were significant factors for improving the safety climate. The results also revealed a better perception of the safety climate for the employees who had participated in safety training courses than other respondents who had not. This study also emphasizes the need for OHSAS 18001-certified companies to pay more attention to providing high-quality safety training for their employees. These may help to improve the safety climate and reduce occupational injuries.

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Disclosure statement

No potential conflict of interest was reported by the author.

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