

REVIEW ARTICLE

A Review of Studies in the Field of Evaluation of Industrial Safety Culture & Safety Climate in Iran

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Received January 11, 2020; Revised February 10, 2020; Accepted February 26, 2020

This paper is available on-line at <http://ijoh.tums.ac.ir>

ABSTRACT

Various studies have shown that unsafe behaviors usually occur in a work environment due to inadequate safety management and safety culture which are the main causes of most workplace accidents. Therefore, this study was aimed to briefly review studies that examined the safety culture and safety climate in Iranian industries. This review study was focused on systematically searching articles from 2009 to 2019 in databases, Google Scholar, SID, Magiran, Science Direct, and PubMed using keywords including safety culture, safety climate, workers, industries, and Iran. The titles and abstracts of articles containing relevant results were extracted over the past 10 years. Then, they were categorized and analyzed according to the title of articles, years of publication, place of publications, type of industries, place of researches, field of studies, methods of evaluation and analysis. The results of various studies and selected articles regarding examining the safety culture and safety climate of industries in Iran showed that the establishment of positive safety culture and safety climate by providing high-quality safety training and implementing appropriate engineering and managerial interventions can boost workers' awareness about existing hazards in the work environment, thereby motivating them to prevent unsafe actions. The state of the culture and safety climate in Iran's industries although cannot be generalized but a positive culture and climate safety can be established in organizations by identifying and evaluating effective components such as senior management's commitment to train workers about hazards in the workplace, avoid unsafe practices and ultimately reduce human errors and accidents.

KEYWORDS: Safety Culture, Safety Climate, Industry Workers, Iran

INTRODUCTION

According to the World Health Organization's (WHO) report more than 120 million occupational accident cases occur around the world annually in which a minimum of 4 individuals was injured per second. The results of a report indicated more than 2 million labors work-related disabilities happened each year and roughly 170 million working days lost due to work-related accidents around the world [1]. International Labor Organization (ILO) estimated that 4% of the world's gross domestic production (GDP) damages caused by work-related accidents [2]. In another report by this organization, some one-third of work-related fatalities were caused by accidents [3]. On the other hand, it has been found that the work-related accidents were more prevalent in the developing countries compared to the developed countries [4]. Work-related accidents were also responsible for many severe disabilities as well as death reasons in Iran. Unfortunately, due to the failure to record the accidents appropriately and the fact that many workers were not actually protected with any insurance coverage, there no accurate data about work-related accidents [5]. Based on the findings of previous studies, it can be concluded that above 80% of job accidents occur due to human errors, whereas the other 20% happened due to the unsafe working conditions or other relevant factors [6-7]. Other safety and health studies showed that 85 – 98% of the work-related accidents caused by unsafe behaviors have their roots in the attitude, behavior, and culture [8]. Therefore, the safety climate was one of the most important factors in different research works affecting safe/unsafe behaviors and the safety culture of workers [9]. The outcomes of a study conducted by Zoher [10] showed that the concept of safety climate plays an important role as a multi-dimensional factor in safety [11]. He formulated, for the first time, a 40-item scale for the safety climate in the metal manufacturing, chemical, textile, and food industries; then performed a factorial analysis to present a 8-dimensional model including the importance of safety training, management's attitude toward safety, safe behavior impact on the promotion, level of safety at worksite, effects of working methods on the safety, supervisor's safety

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state, safe behavior effect on the social state, and commitment to observe the safety principles [11-15]. As a subcategory of safety culture, the safety climate refers to the recognition of common beliefs and perceptions of safety management in work environment among workers at a particular time, providing a sectional description of the safety culture [16-18].

The safety culture term was first used in a nuclear report on Chernobyl disaster in 1987. Based on that report, lack of the safety culture at Chernobyl nuclear power plant had contributed to unsafe behaviors which consequently result to the occurrence of disaster [19-20]. In recent years, questions were raised about defective organizational structures and safety management systems in relation to such large-scale accidents as King Cruise fire or Piper Alpha oil platform disaster, which highlighted the significance of the safety culture [21]. The safety factor is a complex structure that consists of safety attitudes, values, and behaviors of the members of an organization, whose components are subject to change. The safety culture is affected by general culture across the society as well as a dominant organizational culture across the organization [17-22-24]. Firstly, the development of a safety culture tends to correct individual behaviors, and then decrease the rate of human errors and the risk of accidents [9-21-25]. The focus on the safety and health solutions such as the safety culture in an organization not only reduces the risk of accidents, but also has economic, financial advantages, and in long term may cause to return the investment [26-27]. The results of a research showed that the managers' commitment, training, motivations, communication, and worker's participation contribute to the improvement of safety culture. Similarly, Boughaba et al. in a study found that safety culture affects individuals' safety performance [28]. Sansa et al. investigated the relationship between organizational safety culture and personnel's safety culture in the nuclear industry. The results of their study proved that an organizational general culture significantly affects personnel's safety culture [29]. Similar studies have been done in Iran. For instance, Khodaei et al. found that managers can play important roles in the culture-making and

improvement of the personnel awareness by initiating appropriate training programs, adopting job safety plans, and preparing safety instructions [30]. The main causes of industrial accidents detectable in multiple stages including the technical stage, human errors, technical-social stage, and organizational stage. The organizational stage strategy indicates that the workers undertake their tasks within the organization framework considering specific (safety) culture. It has been found that, regardless of the technical defects and lack of engineering controls, the individuals' indolence and pervasive defects (the climate) across the organization are the hidden causes in the majority of current accidents [31]. The protective indices application such as the safety climate, and observance of the behaviors that affect the current safety activities along with the reactive indices, e.g. the accident index had been widely considered during the recent years. Moreover, a combination of protective and reactive viewpoint had been able to help organizations to realize the adopted safety programs' targets sufficiently [32-33]. Accordingly, the present research was aimed to provide a brief review for the literature discussing the safety culture and safety climate in Iranian industries.

MATERIALS AND METHODS

In this review, several databases including PubMed, ScienceDirect, Google Scholar, SID, and Magiran were searched from 2009 to 2019. This search was performed using keywords including safety culture, safety climate, workers, industries, and Iran. The titles and abstracts of articles containing relevant results were extracted over the past 10 years.

Then, these were categorized and analyzed according to the articles' title, year of publication, place of publication, type of industry, place of research, a field of study, method of evaluation, and analysis.

The inclusion criteria were as follows:

- The literatures published in 2019 presenting quantitative/qualitative research works in the past 10 years (from 2009 to 2019).
- Persian and English articles published in domestic and international scientific journals and which contained the mentioned keywords, with their full texts available.
- Articles contained appropriate research factors such as well-defined validity and reliability, sampling method, statistical population, research hypotheses, and research questions that were relevant to the considered subject.

On the contrary, the exclusion criteria were as follows:

- Articles with an unspecified sample size.
- The literatures that were not industry related.
- The article that were duplicated.

In the current study, the inclusion and exclusion criteria based on the title and abstract of the articles were first reviewed. Thereafter, the articles that failed to pass the inclusion criteria were excluded and the remaining criteria were investigated. In the next step, the desired results were extracted considering a number of focused parameters and then handed over to another researcher to have them reviewed and revised, if necessary. Generally, in the present study, 21 articles out of 102 articles were investigated to extract the results (see Figure 1).

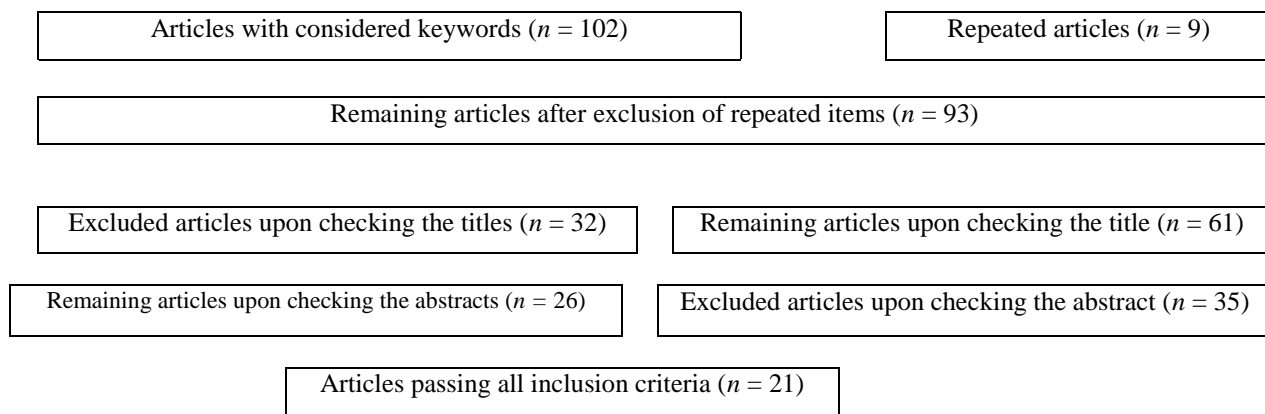


Fig 1. Flowchart of the literature review

RESULTS

Of 21 selected articles, 16 articles have been published in Persian language magazines and 5 articles in English language magazines. These selected articles were generally cross-sectional and related to different industries. A review of the selected articles included as follow: 1) Factors affecting safety culture and safety climate, 2) The Influence of training to promote a safety culture and safety climate, 3) A relationship between safety culture and safety climate with unsafe

behaviors and incidents, 4) A relationship between safety culture and safety climate with job satisfaction, job stress and burnout, 5) A relationship between individual and occupational variables with safety culture, 6) A relationship between HSE management system and technical interventions with safety culture and safety climate, 7) A status of safety climate and safety culture. The final list of the articles has been presented in Tables 1 and 2, respectively.

Table 1. Articles related to the assessment of safety culture and safety climate in Iranian industries - published in Persian journals

Line	Title	Year	Authors	Journal	Industry	Study	Results
1	Identification of factors affecting safety culture in Iranian thermal power plants [34]	2016	Shirazesh Arghami, Mostafapouya, Rahim Goudarzi*	Journal of Occupational Hygiene Engineering	Power plants	Theory	A thematic analysis identified 9 sets of parameters for achieving safety culture as follows: 1) Training, briefing and competency, 2) Vision, leadership and commitment, 3) Laws, rules and work procedures, 4) Safety and crisis management, 5) Individual agents, 6) Management style and organizational communication, 8) Participation and commitment of personnel, supervisors and middle managements, 9) To become available foundations and source managements.
2	A relationship between safety climate factors and the risk of dangerous situations in height among construction workers [35]	2011	SB. Mortazavi*, H. Asilian, M. Avestakhan	Iran occupational health journal	Construction	Theory	Factors of safety attitudes of workers, the level of risk in construction site and working relationships derived from factor analysis were 57% of the total variance. Situations of working on scaffold without guard rail and protect the edges, access to the scaffold by going up and down connections and the ladder not secure were usually seen in the most construction sites.
3	Investigation on the relationship between	2018	Mahboobeh Eshaghi,	Journal of North Khorasan	Profiling Industry	Descriptive-analytic-	Average safety culture score of the individuals was found to be 278 ± 2.43 . The individuals were found to exhibit unsafe behaviors at 46%, with

	safety culture and rate of unsafe behavior among workers at Ekbatan Profile Manufacturing Industry [36]		Parvin Sepehr*	Medical Sciences		Cross section al	the maximum and minimum rates of the unsafe behaviors been corresponding to failure to wear earing protectors consistently and throwing the tools, respectively. On average, the individuals' safety score was evaluated as positive. The results indicated a significant association between the safety culture score and the rate of unsafe behaviors ($p = 0.032$). This means that the rate of unsafe behaviors was higher at lower safety culture scores.
4	The influence of safety training on safety climate improvement in construction sites of a firm [37]	2014	Jafari MJ*, Gharari M, Kalantari S, Omidi L, Ghaffari M, Asadolah Fardi GRMohtasham Ghafari,	Journal of Safety Promotion and Injury Prevention	Construction Sites	Semi - experimental	The training intervention could improve the mean and standard deviation of the safety climate factors in workshops 1 and 2. The results also showed that the training intervention increased the mean scores assigned to the management commitment, safety training, safety communication, effect of worker's safety interventions, permit issuance system, safety regulations, and safety regulation violation.
5	Assessing the effect of training on the safety culture improvement regarding personal protective equipment (PPE) wearing [38]	2018	Parvin Sepehr*	North Khorasan Journal of Medical Sciences	Casting industry	Analytical descriptive	Average safety culture score of the individuals was found to be 243. Of 12 safety culture dimensions, wearing of PPE gained an undesirable score of 20.21. Obtaining a score of 13.02, the level of safety training was found to be below the desired level. The scores of the PPE and safety training reached the desired levels after the intervention. Post-intervention safety culture score was 281. Effectiveness of the safety training at $p = 0.015$ indicated that conditions were improved following the intervention.
6	Safety culture assessment and determination of its	2016	Mohsen Mahdinia , Alireza Koohpaei , Shahram	Journal of Health System Research	Industries of Qom Province	Cross-sectional, analytical,	The mean \pm SD score of the safety culture was 3.30 ± 0.73 . The highest score was obtained in the dimension of cooperation and collaboration (3.53 ± 0.45) and the lowest score was reported in the environmental

	predictive demographic and occupational variables among industries in Qom province, Iran [39]		Arsang-Jang, Abbas Sadeghi*, Javad Malakuoti, Ali Karimi			descriptive	and safety priority dimension (3.06 ± 0.86). Size of the industry, work history, smoking, and working hours per day had a significant correlation with safety culture and explained 19.9% of the safety culture variation ($P > 0.01$).
7	Assessing safety culture and its influencing factors in a steel-manufacturing plant [40]	2016	Mohammad Hossein Rezaei Baghbidi*, Gholamhossein Halvani, Samira Ghiyasi,	J TOLOOE BEHDA SHT	Steel-Manufacturing Plant	Cross-sectional	The average final score safety culture among participants in this study was $167/98 \pm 22/07$ from the total score of 325. The difference of scores of safety culture in various educational groups was statistically significant ($p=0/02$). In addition, the difference of safety culture total score were statistically significant among workers with and without accidents ($p=0/02$).
8	Effect of engineering and management interventions on promoting safety culture indicators among workers of Iranian Pipe Rolling Factory [41]	2012	Sepehr P, Mohammad Fam, Ketabi D, Sepehr N	Bi-monthly scientific research journal Yazd school of health	Pipe Rolling Factory	Descriptive – analytical	The research results showed that average value of the ultimate safety culture index increased from 204 ± 42.43 (negative safety culture) prior to the engineering and managerial interventions to 318 ± 31.11 (positive safety culture) after the interventions. The results also showed that all 10 indices of the safety culture increased significantly after the interventions.
9	Survey of Safety Culture and Its Relation to Work-Related	2017	Hamidreza Najmabadi, Gholamhossein Halvani, Alireza	Occupational Hygiene and Health Promotion Journal	City Train Project	Descriptive – analytical	The overall average of safety culture score in the urban train was 2,420, which was a positive project culture. Among various dimensions of safety culture, the lowest mean safety culture score was related to the work environment dimension (58.5%) and the highest average was priority to

	Accidents in a City Train Project [42]		Esmseili, Hamideh Mihsnpour*				safety (84%). The most common cause of accidents was surface damage (66.6%). There was a significant relationship between safety culture with age groups and job satisfaction ($P < 0.05$).
10	Assessing the safety culture among personnel at South Pars Gas Complex [43]	2017	Fatemeh Rahmati Najjar Kolaei, Hesam-al-Din Monshi, Masood Rezaei*, Mohammad Abbasi	Iran Occupational Health	South Pars Gas Company	Descriptive	In general, the findings of workers' behavioral checklist showed that the state of safety was appropriate. Nevertheless, some of the safety items on this checklist require more attention. On the contrary, the environmental checklist showed that a company has failed to perform properly when it came to training, first aids, machinery safety, chemicals, pressurized vessels, lighting, noise reduction, vibrations, and ergonomic considerations. Accordingly, the company was recommended to consider the mentioned factors when planning for improved safety culture.
11	Investigation on a relationship between safety climate and safety performance among personnel considering the mediating roles of safety knowledge and safety motivation at Sarcheshmeh Copper Complex [44]	2015	Abbas Khaleghi Nejad*, Mohammad Zia-al-Dini	Journal of Health and Safety at Work	Sarcheshmeh copper complex	Applied, descriptive-survey	Supporting all research hypotheses, the obtained results showed that the safety climate affect the safety performance directly. Moreover, the safety knowledge and motivation played a mediating role in the relation between the safety climate and safety performance. In addition, the safety knowledge was found to affect the safety performance through the safety motivation. Based on the research results, it is recommended to improve the workers' safety climate by reinforcing factors affecting research model. In this way, one can upgrade the workers' safety knowledge while boosting their safety motivation.
12	Relationship between	2016	Mehdi Zarej	Journal of	Shahid	Descriptive-	The results indicated a significant relationship between the safety

	safety culture and job satisfaction in employees of Shahid Rajaee port [45]		Teamur Aghamolaei,* Sakineh Dadipoor, Ali Safari Moradabadi, Fatemeh Alsadat Hosaini	preventive medicine	Rajaee port	analytical	culture and the job satisfaction ($p < 0.001$). Among various dimensions of the safety culture, the safety training and learning and responsibility were the strongest correlations related to the job satisfaction. When it came to the various dimensions of job satisfaction, the strongest correlations to the safety culture were exhibited by the nature of the job.
13	Analyzing workplace safety climate using Nordic questionnaire: a case study in a metal industry [46]	2016	Gholam Abbas Shirali, Fazlolahe Khademi an*	Iran Occupational Health	Metal industry	Descriptive	Calculation of the mean safety climate scores showed that the total mean of safety climate was 2.88. The highest and the lowest score were related to workers' trust in the efficacy of safety systems (3.35) and management safety justice (2.69), respectively. The results showed that there was a significant relationship between age and experience with safety climate. Similarly, there is a significant relationship between the job position and job type with safety climate. But, there was not observed significant relationship between variables such as shift work, education level and type work contract with the safety climate.
14	Relationship between safety culture and job stress among the personnel of Telecom Companies [47]	2016	Zahra Zamanian, Solmaz Zakian, Maryam Jamali, Bahram Koohnavard*	Journal of safety promotion and injury prevention	Telecom Companies	Descriptive, cross-sectional	Out of the studied individuals, 56.1% showed negative safety factor, while the remaining 43.9% had positive safety culture. High levels of stress were reported for 79.6% of the workers. Regarding the relationship between the safety culture and the education level, individuals with education levels below the high school diploma showed lower levels of the safety culture, as compared to those with higher education levels. Investigating the relationship between the safety culture and job-related stress was further performed using independent t-test, and the results indicated a negative yet significant

						association between the two variables.	
15	Job burnout and safety climate relationship and their role in work-related accidents in an Iranian port [48]	2015	Mohammad Khandan, Alireza Koohpaei *	Journal of Sabzevar university of medical sciences	Iranian port	cross-sectional	The average age was 31.58 ± 5.71 and also work experience was 7.75 ± 4.78 years. Considering the outcomes of analysis, job burnout score was calculated 76.17 ± 8.9 and safety climate was determined equals to 188.7 ± 23.07 . There were significant differences ($p < 0.05$) associated with job burnout and safety climate ($r = -0.44$). Also, a significant relationship were between job burnout, safety climate and their components with reported accidents ($p < 0.05$).
16	Safety Climate as an indicator to evaluate the performance of occupational health and safety management system [49]	2011	Adl J, Shokoohi Y, Kakooei H	Ardabil Health Magazine	Petrochemical industry	cross-sectional	7 out of 21 elements of OSHMS, did not get minimum score (i.e. score 2) required. Of 17 dimensions considered in safety climate, 9 dimensions did not obtain the minimum required score (i.e. score 6). Whereas, in total the safety climate scores which had normal distribution, were consistent in different dimensions with the OSHMS performance evaluation points.

Table 2. Articles related to the assessment of safety culture and safety climate in the Iranian industries - published in English journals

Line	Title	Year	Authors	Journal	Industry	Methods	Results
1	Evaluation of safety climate factors - a macro ergonomic approach: a Case study in Iran [50]	2012	Mohammad Khandan, Shahram Vosoughi*, Maryam Maghsoudipour	Iranian Rehabilitation Journal	Petrochemical Company	Case Study	The results indicated that safety climate mean score was 154.84; and 68.7% of workers had positive safety attitudes. In addition, we found a significant relationship between ages on safety climate ($P < 0.05$). The safeness of work environment and emergency preparedness in the organization with weights of 0.197 and 0.144

						respectively were the highest and lowest weights which were obtained by entropy,.
2	Investigating a relationship between level of awareness around health, safety and environment management system and its effects on safety climate and risk perception by employees in an Iran oil refinery, 2015 [51]	2016	Milad Ahmadi Marzaleh, Shahram Vosoughi*, Amir Kavousi, Hosein Jameh Bozorg	Iranian Journal of Health, Safety & Environment	Oil Refinery	Cross-sectional The results showed that a significant relationship between safety climate and awareness level of HSE management system; also a significant relationship between safety climate and perception of risk. However, there was not a significant relationship between perception of risk and awareness level of the HSE management system. The results of this study showed a moderate awareness of HSE management system in refinery workers. In this regard, appropriate and proper management policy should be considered to improve the situation.
3	The role of safety management system in safety culture in an oil and gas exploration and production company in Asalouyeh, Bushehr Province, Iran, in 2015 [52]	2015	Afroghi SA, Mirzaei R*, Nasrabad i M	Journal of Occupational Health and Epidemiology	Oil and gas	Field research The results showed that all indices on obtained values were very desirable. In addition, the results of this research indicated that there was a statistically positive and meaningful relationship between the variable of safety management system and its components (i.e., safety policies, employees' motivators, safety education, urgent prevention plans, and internal control), and safety culture (P<0.01). High education levels of employees had meaningful impact on the safety management system (P<0.01). However, there was no a statistically significant relationship between the education level and occupational background of

							employees and company's safety culture ($P>0.05$).
4	Diagnosis of poor safety culture as a major shortcoming in OHSAS 18001-certified companies [53]	2016	Abolfazl GHahramani*	Industrial Health	Manufacturing companies	Descriptive	The certified companies had a better OHS practices compared to the non-certified companies. The certified companies slightly were differing in OHS and OHSAS 18001 practices and one of the certified companies had the highest activity rates for both practices. The results indicated that the implemented management systems had not developed and been maintained appropriately in the certified companies. The in-depth analysis of the collected evidence revealed shortcomings in safety culture improvement in the certified companies.
5	Investigating safety climate and its structural dimensions in a sugar industry using Nordic Questionnaire (NOSACQ-50)[54]	2014	Mirzaie Ali Abadi M1, Feize Arefi M*, Gholami S, Chahardooli Z, Rostami F	Journal of Occupational and Environmental Health	Sugar Industry	Cross-sectional	The maximum average score of safety climate was observed for safety management power dimension (2.52 points) and the minimum score belonged to the reciprocal safety relation dimension, learning and reliance on the ability of safety (1.58 points).

DISCUSSION

The safety culture and safety climate are psychological phenomena that express a worker's perception about his/her safety situation at a particular time; being accompanied with environmental and situational factors, these are temporary in nature and subject to change [35]. As of present, the safety culture and safety climate are among the topics discussed in the scope of system safety and risk management [55]. Improvement of the workers' safety culture and safety climate in a work environment is believed to be a solution for enhancing the workers' safety and reducing the job-related accidents [37-47-48]. Various

studies, including those selected in this research about the worker's safety culture and safety climate in Iranian industries have been focused around the following axes:

1. Factors affecting the safety culture and safety climate: various studies have referred to a number of different factors including top management attitude and commitment, safety training for workers, personnel's awareness and qualification, working regulations, laws, procedures, and routines, management style and organization

communication, participation and organizational commitment of workers, supervisors, and middle managers, safety and crisis management, provision of infrastructures and resource management, extra-organizational factors, permit issuance system, promotion for safety, accident reporting, workers' knowledge of and attitude toward the safety, safety observation, safety priority, safety promotion, safe behavior inhibitors, violation of safety regulations, improvement of safety laws and regulations, perception of risk, risk level, supportive workspace, physical workspace, individual priorities and the safety requirement, common values, organizational activities, accidents and events, change management, work pressure, safety justice, safety management power, worker's confidence about the adequacy of the safety systems, etc. as the most important factors affecting the safety culture and safety climate in organizations [10-26-34-35-40-49-50-54-56-60].

2. The effect of safety training and awareness about HSE management system to improve safety culture and safety climate: An efficient and fundamental solution for improving the safety culture and safety climate in an organization is to hold training programs based on a training needs assessment [61]. Indeed, an organization can move toward a change to positive safety culture and safety climate by providing consistent, participative, and integrated training programs [62]. Safety training, including awareness about HSE management system was among the most important dimensions of a safety climate, so that the safety climate was expected to enhance significantly by improving training system, training material, and training quality. A safety and HSE management system training tend to improve the degree to which individuals were familiar with safety regulations and routines and the work environment hazards. As a result, the safety and HSE communications are enhanced while the violation of the safety principles declines. On the other hand, the safety interventions by workers may increase relatively the safety training courses as the individuals are taking more stringent actions against their violating colleagues. In their studies, researchers placed an emphasis on the importance and roles of the attitudes adopted by a manager, supervisors, and workers toward the work environment safety and

health, referring to such attitudes as a significant factor contributing to healthy and safe behavior [63]. Therefore, the training interventions must be particularly focused on this variable as it can facilitate the improvement of the safety performance as a prerequisite of the behavioral changes [37-38-64-68].

3. A relationship between safety culture and safety climate, in one hand, and unsafe behaviors and occurrence of accidents, on the other hand: Like any other Socio-psychological phenomena, the safety culture, and subsequently the safety climate, was inherently linked to the behavior [69]. The results of studies performed so far showed that the root cause of a majority of job-related accidents was the unsafe behavior(s) exhibited by individual(s), which were the most commonly developed in work environments dominated by inappropriate safety culture and safety management. It is trivial that the development of a safety culture tends to correct the individual behaviors, in the first place, inhibit unsafe actions, reinforce safe behaviors, and ultimately decrease the rate of human errors and accidents [9-38-42-56-70].
4. A relationship between safety culture and safety climate, in one hand, and the job satisfaction, job-related stress, and job burnout, on the other hand: Evaluating the relevant literature, it was found that this relationship was statistically significant. Institutionalization of the safety culture without taking care of different aspects of the job for different individuals, including the job satisfaction, was condemned to failure [71]. Indeed, organizations must undertake to perform job redesign in terms of software and hardware aspects of the job within the framework of optimal job burnout management systems, implement stress control management plans, adopt behavior-based safety principles with an emphasis on the institutionalization of the safety culture at all levels across the organization, invoke active and effective participation of leaders for establishing job motivation, ensure supportive and consistent surveillance by supervisors, provide the workers with promotion opportunities, fairly raise the salaries and benefits, place an emphasis on workers' sense of responsibility, and hold training courses to boost workers' level of job satisfaction,

- thereby improving their safety behavior and performance in the organization [45-47-48-72].
5. A relationship between individuals, job-related variables, safety culture, and safety climate: Based on the results of the investigated studies, particular factors play positive/negative roles in the improvement of safety culture and safety climate across an organization, including the age, gender, work experience, educational level, marital status, working hours, size of the industry, job type, etc. However, given the contradictions observed across the results of various studies, there is a need for performing more comprehensive studies in this respect. In general, however, the findings of the relevant literature showed that improved safety culture was anticipated at older ages [25-39-42-73] and/or higher work experiences [30-39-58-73-76], though an increase in working hours tended to attenuate safety culture [39-77-79]. Moreover, it was found that the larger industries, as compared to the smaller ones, enjoyed a better situation in terms of the safety culture [22-39-73].
 6. A relationship between the presence of HSE management system and initiation of technical and managerial interventions, in one hand, and the safety culture and safety climate, on the other hand: In many work environments and industries, HSE and occupational health management systems have been implemented [80]. The safety climate has been used as a robust indicator and predictor of the overall efforts made across the safety management system in the industrial sector [81]. The results of relevant studies showed that the dominant safety climate across the industrial sector was affected by the performance of safety and occupational health management system, making it a good metric of the system performance [49]. It has been further found that such engineering and managerial measures as high-quality safety training can improve both the safety culture and safety climate across an organization [41-82]. Therefore, implementation of OHSAS 18001 may not necessarily guarantee that the safety climate improvement [83].
 7. States of the safety culture and safety climate: The results of various contributions suggested that no accurate judgment about the states of safety culture and safety climate across Iranian industries can be made, as some of the existing reports have evaluated the states of safety culture and safety

climate as good [42-50-51-76] while some others have reported barely intermediate [7-84-85] or even weak safety culture and safety climate [54-74]. In fact, the conclusions drawn by such studies have been affected by the type of investigated industry, investigation method, and many other factors, so that more extensive studies are required to appropriately account for the type of industry, functional nature of job, and other influential factors. Anyway, if an accurate evaluation of the safety culture and safety climate across Iranian industries can be obtained, the results can be effectively used to identify and evaluate potential work environment problems, enhance the workers' efficiency, and lower the rate of job-related accidents [49-51-68-86]. Presented in the following was a summary of the articles focusing specifically on the safety culture and safety climate in the Iranian industries (other than those mentioned in Tables 1 and 2).

Zare et al. presented a study where they investigated the states of safety climate among workers at Golgohar Mining Industry (Sirjan, Iran). This descriptive-analytic cross-sectional study was performed on 534 individuals working at the company. In this work, a safety climate scale was used to evaluate the safety climate. The results showed that the production pressure and training were the weakest and strongest factors, as per the scores of 5.38 and 7.70, respectively. The overall safety climate score across the site was found to be 6.35 (out of a 1-10 scale) [7].

Another study was presented by Adl et al. to evaluate the safety climate in a steel manufacturing industry. In this work, the instrument developed by Loughborough University was adopted to evaluate the state of safety climate in an Iranian steel manufacturing company. The required data was collected using a questionnaire, focused group discussions, interviews, and purposive observations, with safety climate scores assigned in 17 different scopes. The graphical index showed a safety climate score of 4.89 ± 2 . The highest and lowest scores corresponded to individual priority and safety requirement (8.6 ± 0.8) and the accidents and events (1 ± 0.00), respectively. After performing a number of statistical assessments including one-way analysis and t-test, a significant relationship was found between the educational level and work experience, in one hand, and the attitudinal aspects of the safety climate, on the

other hand ($p > 0.05$). Regarding age criteria, this relationship was significant only when management commitment ($p = 0.03$) or personal priorities ($p = 0.02$) were concerned. Regarding employment status, this relationship was only significant with work environment ($p = 0.04$) [87].

Sholouhi et al. conducted a study about the safety climate of a petrochemical industry located in Mahshahr Economic Zone (Mahshahr, Iran). In this descriptive-analytical cross-sectional research Loughborough Safety Climate Assessment Toolkit (LSCAT) was used to assess the dominant safety climate of the considered industry along 17 different dimensions, giving a score of 1 – 10 for each dimension, where the score 6 was the border between weak and moderate safety climate. According to the results, average score of safety climate for the investigated industry was 6.03. Among the 17 dimensions examined in this work, the safety climate was assessed as weak (corresponding to scores below 6) along 8 dimensions. Among others, the dimensions of accidents, incidents, and change management were found to suffer from the worst statuses (corresponding to a score of 4). The best score (8.65) was related to the individual priorities and safety requirements. For most of the dimensions, no significant association was observed between the safety climate and personal variables including age, work experience, and level of education ($p > 0.05$) [85].

Alimohamadi et al. performed a research to assess the safety culture and affecting factors in a detergent manufacturing company. In this work, a standard safety culture questionnaire (developed in 2010) was used to evaluate the level of safety culture. Different aspects of the safety culture in this study included (1) management commitment, training and information exchange, (3) supportive environment, (4) inhibitors, and (5) priority of safety. The results indicated an average safety culture score of 180.51 ± 35.216 among participants, with the difference in the safety culture score among various job groups being statistically significant. In addition, the difference in the safety culture score was significant between the individuals who already experienced some job-related accidents and those who were yet to attain such an experience [59].

A study was performed by Shekari et al. to assess the safety culture among petrochemical company laboratories workers. A standardized safety

culture questionnaire was used in this descriptive-analytical study. The questionnaire was consisted of 40 questions in five scopes: training, work environment, priority of safety, information exchange, and management commitment. All workers at the mentioned laboratories were considered to form the statistical sample. A five-point Likert scales was utilized to record responses. The results of this study showed an average safety culture score of 136.7 for laboratories workers, which was positive based on the rule declared in this research. Moreover, the highest score (31.9) was the priority of safety while the management commitment showed the lowest score (25.2) [76].

Kalteh et al. performed a study to assess the climate and evaluate factors affecting safety climate among workers in an Iranian dairy company. This study was conducted through a cross-sectional approach in a dairy company in Golestan Province, Iran. The statistical population was consisted of 164 persons who served as managers, staffs, and workers, with the specific individuals selected on a random basis. In this piece of research, Nordic safety climate questionnaire (NOSCAQ-50) was adopted as the research instrument. Among the various dimensions of safety climate considered in this study, the “priority of safety for workers and risk-averseness” and “safety communication, learning, and reliance on the safety adequacy of workers” obtained the lowest (2.24) and highest (3.33) scores, respectively. Moreover, among the various occupational and individual factors considered in this work, the level of education exhibited the most significant association with the safety climate ($p < 0.05$) [88].

Khodaei et al. presented a research which was aimed to assess the safety culture among wood and paper companies in northern Iran. In this descriptive cross-sectional investigation, a total of 236 workers were examined and the required data was collected by means of questionnaires with proven reliability and validity. The findings of this research proved that 8 factors imposed the largest contributions to the establishment of the safety culture which together could describe 45% of the variance in the safety culture. Accordingly, three most effective factors including management commitment, orientation of safety regulations, and safety instructions could describe 11.41, 9.60, and 5.05% of the variance in the safety culture, respectively. This was while all of 8

factors could effectively improve the safety performance and appropriate development of safety in studied companies. In this respect, managers could play important roles in culture-making and enhancement of their workers' awareness by holding appropriate training programs, ensuring work safety, and preparing effective safety instructions [30].

In another work, Mirzaei Aliabadi et al. focused on the safety climate and its structural dimensions in a sugar industry using NOSCAQ-50 questionnaire. Being a cross-sectional trial, the mentioned study took 50 workers of the same working shift and assessed seven dimensions of the safety climate. Based on the results, the highest average score was safety power of management (2.52), while the lowest score referred to the mutual safety communication, learning, and reliance on safety abilities (1.58) [54].

According to a report by National Institute for Occupational Safety and Health (NIOSH), 94% of all job-related injuries and illnesses were caused by human behaviors. Accordingly, although the actions of the safety engineers have effectively reduced the level of job-related accidents and illnesses, but these are not enough, because it has been impossible to adequately justify the reason(s) why some individuals tend to act unsafe behaviors even when the requirements of safe work is already in place [89]. AN unsafe behavior refers to an action that goes beyond the predefined standards declared for the system and hence can affect the system safety [59]. It has been acknowledged that a definite solution for reducing the rate of unsafe behaviors is to improve the indices of the safety culture [9]. When an organization is supported by a strong safety culture, individuals tend to do safer behaviors, leading to fewer accidents and significantly lower accident-related damages and losses [59]. It has been virtually impossible to develop a safety culture by modifying individuals' motivations without considering their job-related and organizational aspects, or by altering individuals' behaviors without considering their motivations and organizational systems, or by changing the systems without taking into account the interactions between behavioral psychological and organizational factors [90]. The outcomes of large number of research works showed that the social psychologists have figured out that the individual's attitude serves as the most important predictor of his/her behaviors [91]. In order to promote

safe behaviors, at least to factors are important. These are management commitment to safety and expression of this commitment through the manager's words and actions, so that workers can effectively perceive safety concepts. This finding emphasized that the presence of equipment, written regulations, and training materials cannot necessarily correct the unsafe behaviors, but rather the workers must understand that their manager consider the safety as an excellent value. In addition, establishing positive communication, information exchange and consulting (calling for solutions) with workers when making decisions tend to boost their sense of ownership. All of these can contribute to safe behaviors and a positive safety culture [26-92]. Studies on the effect of mental and organizational factors on the behavioral risk and probability of job-related injuries in work environment have shown that the safety climate have greatly impacts on the mentioned factors [10]. Researchers have found that the safety climate not only serves as a mediator between the organizational climate and safety performance, but also explains the individuals' perception of the safety values in work environment [93-94]. Numerous studies have been performed to assess safety climate and affecting factors, and the results indicated that an accurate evaluation of safety culture and safety climate can be effectively used to identify and evaluate potential work environment problems, enhance efficiency, and reduce the rate of job-related accidents [32].

CONCLUSION

Based on the different pieces of literature considering the safety culture and safety climate, generally it was found that establishment of positive safety culture and safety climate across an organization by providing high-quality safety training and implementing appropriate engineering and managerial interventions can boost workers' awareness about existing hazards in work environment, thereby motivating them to prevent unsafe actions. This is possible only if the factors affecting the safety culture and safety climate are properly identified and assessed and, even more importantly, if the managers and supervisors improve their commitment to safety and see the safety issues as a priority in the work environment.

ACKNOWLEDGMENT

The authors would like to thank all persons in Occupational Health and Work Safety department of Hamadan University of Medical Sciences who have helped researchers in this study.

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