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Original Article

A Study of the Causes of Occupational Accidents in Manufacturing Companies

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Abstract

Background: Studies have found that several individual and organizational factors influence the occurrence of accidents. Researchers have also highlighted the need for the development of new accident models. The main aim of this study was to assess the contributing causes of occupational accidents using a questionnaire. **Methods:** A total of 365 managers and employees participated in the current study from 9 manufacturing companies located in the northwest of Iran. A questionnaire comprising 100 accident causes was used to gather the required data for this study. **Results:** Exploratory factor analysis (EFA) yielded 14 factors contributing to accidents, and confirmatory factor analysis found satisfactory fit indices for the EFA model. The participants reported unsafe acts as the most important factor for the occurrence of accidents. A *t*-test revealed that participants who received safety training experienced fewer occupational accidents than other respondents. The one-way analysis of variance showed that the companies significantly differed in the perception of accident causes. Structural equation modeling indicated that organizational-managerial factors had a larger effect on individual factors than external factors. **Conclusion:** The results indicate that providing safety training is necessary to control the employees' unsafe acts. Managers of the companies should pay special attention to the organizational factors affecting the occurrence of accidents. The findings of this study might help the managers to develop more targeted countermeasures for reducing occupational accidents.

Keywords: Accident models, organizational factors, safety training, temporary workers, unsafe acts

Introduction

Safety researchers have made considerable efforts to explore the causes of accidents in workplaces, and many models have been developed to better understand the factors that affect the occurrence of accidents. These efforts have led to the identification of several individual, organizational, and external factors that can contribute to occupational accidents. Meanwhile, control measures have also developed to reduce the events; however, the application of the measures was not adequately effective in developing countries.[1] Hence, it is necessary to perform the new researches to better understand the contributing factors on the occurrence of accidents.

Hovden *et al*. categorized the accident models into four groups.[2] These categories included causal sequences similar to the domino model; descriptive models of accident processes in terms of sequentially timed events; system models based on a mixture of causal sequences and epidemiological models; and logical risk analysis inspired models. The accident theories are divided by Holnagel into four categories, namely sequential, epidemiological, systemic, and functional.[3,4] Furthermore, Khanzode *et al*. classified accident theories and models into four generations of accident proneness, domino theories, injury

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epidemiology, and system models.[5] These authors stated that the person-as-cause theme examines individual-related factors (e.g., age, experience, and education) and reflected in the first generation of accident theories. The second and fourth generations account for the system-as-cause theme and investigate organization-related factors (e.g., management commitment to safety, and workgroup size). System-person sequence examines job-related factors (e.g., occupation and hazards in the work system) and reflected in the third generation of accident models.

Accident researchers also attempted to develop theories that can easily describe the influencing factors on the accident process. For instance, Attwood *et al*. reviewed accident causation models and divided them into three categories of early accident models, models based on holistic approaches, and primarily quantitative and statistical models.[6] The authors proposed that influencing factors on accident process include direct (e.g., worker behavior), corporate (e.g., training and safety culture), and external (e.g., financial elements and regulatory aspects). In addition, Rasmussen and Suedung stated that all actors and decision-makers who influence the normal work process in an organization might also directly or indirectly influence the accident scenarios.[7] The authors proposed a classification of the sociotechnical system involved in the control of safety comprising the following six levels: the work and technological system, the staff level, the management level, the company level, the regulators and associations' level, and the government level.

Other studies have indicated that the probable influencing factors on the occurrence of accidents include task-related factors, personal situation, and organizational factors;[8,9] direct causes (e.g., failure to carry out specified equipment checks), level one (e.g., insufficient or ineffective training), and level two (poor human resource management) factors;[10] physical (e.g., equipment design), corporate (e.g., training), and individual (e.g., experience) level factors;[11] person (e.g., employee attitudes and behaviors), system (e.g., system design), and system–person sequence (system factors affect safety outcomes through people).[12] Sklet reviewed accident investigation methods and concluded that most of the examined methods are limited to focus on the work and technological system at the company level (inside an organization).[13] The author suggested investigating the external influencing factors including government and regulator on the accident process. Therefore, external, organizational, and individual factors should be considered to better understand the influencing factors on the occurrence of accidents.

Despite a high number of studies were conducted to find the contributing causes of accident, researchers highlighted the need for the development of new accident models or updating the existing ones.[3,14-16] They pointed to the inability of the existing models to decrease accidents due to the major changes taking place in new systems. On the other hand, the government and regulatory factors scarcely considered by researchers in modeling accident causes.[13] In addition, taking into account the opinions of employees working in workplaces due to their familiarity with the safety risks and experiences learned from workplace events can provide reliable knowledge about the causes of occupational accidents. Therefore, the current study aimed to identify the contributing causes of accidents based on the opinions of employees in manufacturing companies considering influencing factors from inside and outside the organizations.

Methods

The present study was conducted in 9 manufacturing companies. The companies were located in Northwest of Iran and were producers of electricity, chemical, metal, beverages, and electrical products, as well as goods used in construction and agriculture. The data needed for this study were collected from 365 managers and employees who worked in the companies. A few of the participants (n = 8) were female, and they were thus excluded from the analysis leaving 357 respondents. The mean age, working experience, and job tenure of the sample were 37.03 years (±7.35), 12.64 years (±6.34), and 9.50 years (±6.29), respectively.

The safety literature was reviewed with the aim of the present study to find the contributing factors on the occurrence of an accident from outside and inside an organization.[6,17-23] A questionnaire comprising 100 accident causes was developed and used to gather the required data for this study. The questionnaire consisted of two parts. The first section designed to collect background information about the participants, accident experience, and engagement in safety training courses. The second section consisted of the causes of accidents. The respondents answered 1-point for "not very important" and 5-point for "very important." The respondents were assured about the anonymity and confidentiality of the data.

Two kinds of occupational injury data were collected in this study: self-reported and organizational records. The participants asked for their experience of occupational injury during the past 3 years. In addition, the recorded occupational injuries in the companies for the year of study and 5 years before it were obtained to check the association between the causes of occupational accidents and occupational accident rates (AR). The means of 5-year injury data were used for the purpose of statistical analysis.

After a descriptive analysis of data, a *t*-test was used to evaluate the relationship between accident causes and occupational accident experience, participation in safety training, and job level. A one-way analysis of variance (ANOVA) was used to test the association between the accident causes and demographic variables, occupational groups, and companies. Exploratory factor analysis (EFA) was conducted to identify the underlying dimensions of the questionnaire. Confirmatory factor analysis (CFA) was used to confirm the identified dimensional structure of the causes of accidents. In addition, structural equation modeling (SEM) was carried out to test the adequacy of

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a proposed model. CFA and SEM were performed using AMOS version 18. We applied several criteria to evaluate the models' fit including the ratio of χ^2 to the degrees of freedom (<2), root mean square error of approximation (RMSEA <0.06), comparative fit index (CFI ≥0.90), goodness of the fit index (GFI ≥0.90), the adjusted goodness of fit index (AGFI ≥0.90), and normed fit index (NFI ≥0.90).[24,25]

Results

As shown in Table 1, the majority of participants were married (91%), and more than half of them had received a tertiary education (54.2%). Most of the respondents involved in production units (47.2%). The majority of the participants were employees (87.1%), and they had recruited contractually by the companies (75.1%). The grouping of age, working experience, and job tenure revealed that most of the respondents had 30–39 years old (40.9%), 11–15 years working experience (28.9%), and 1–5 years of job tenure (29.4%).

Principal component analysis with varimax rotation method was used to identify underlying factors that influence the occurrence of accidents [Table 2]. Initial eigenvalues indicated that the identified factors explained 67.04, and the first factor explained 29.47% of the variance. The analysis resulted in the retention of 14 factors with 78 items. A total of 22 items were eliminated because they failed to meet the minimum criteria of having a primary factor loading of 0.4, or the number of loaded items for each factor was fewer than three. The application of CFA indicated that the fit indices for previously identified model by EFA is satisfactory (χ^2/df = 1.99, GFI = 0.714, AGFI = 0.687, CFI = 0.82, RMSEA = 0.053, NFI = 0.67). The values for the ratio of χ^2 to the degrees of freedom and RMSEA were acceptable. The Cronbach's α for the whole scale was 0.87, and it is reported for each factor in Table 2.

The mean scores for the causes of accidents were 3.78 (±0.53). Unsafe acts (factor 2) had the highest score (3.96 [±0.73]) and inappropriate planning for safety (factor 7) had the lowest score (3.53 [±0.69]) [Figure 1]. The identified factors were classified into three new conceptual factors. Factors 1, 2, 3, and 10 combined to make a new factor entitled individual factor, factors 4, 5, 6, 7, 11, and 12 combined to make organization-managerial factor, and factors 8 and 9 combined to make outside environments of the companies (external) factor. A descending order of the mean scores of the new factors ranked as follows: individual factor (3.87 [±0.59]), organization-managerial factor (3.76 [±0.58]), and external factor (3.71 [±0.68]). The results obtained from SEM support the full theoretical model ($P < 0.001$). In addition, the assessment of overall fit indices for proposed model indicated that indices were acceptable (χ^2 = 6.83, df = 2, P = 0.033, GFI = 0.99, AGFI = 0.95, CFI = 0.98, RMSEA = 0.82, NFI = 0.98). Although the value for the ratio of χ^2 to the degrees of freedom was more than two and for RMSEA was more than the acceptable level, we considered other indices. Examination of the path coefficients for the model [Figure 2] indicated that three of the proposed paths were significant ($P < 0.001$) [Table 3].

Table 1: Personal and occupational characteristics of the respondents

Variable	*n* (%)
Age groups (years)	
<30	74 (20.7)
30-39	146 (40.9)
40-49	121 (33.9)
50-59	16 (4.5)
≥60	0
Marital status	
Married	325 (91)
Single	32 (9)
Working experience (years)	
<1	4 (1.1)
1-5	50 (14)
6-10	87 (24.4)
11-15	103 (28.9)
16-20	60 (16.8)
>20	53 (14.8)
Education	
Primary	13 (3.4)
Lower secondary	36 (10.1)
Upper secondary	114 (31.9)
Tertiary	194 (54.3)
Job tenure (years)	
<1	18 (5)
1-5	105 (29.4)
6-10	93 (26.1)
11-15	81 (22.7)
16-20	35 (9.8)
>20	25 (7)
Nature of job	
Production	169 (47.3)
Maintenance	82 (23)
Office	56 (15.7)
Warehouse worker	28 (7.8)
Driver	13 (3.6)
Etc.	9 (2.5)
Recruitment	
Permanent	89 (24.9)
Contractual	268 (75.1)
Job level	
Manager	46 (12.9)
worker	311 (87.1)

The AR_1 of study year in all companies except companies 6 and 9 was higher than the means ARs of the previous 5 years (AR_5). The company 6 had the highest AR and the company 8 has the lowest AR among companies. The *t*-test analysis did not find significant differences between reported experiences of occupational accidents and identified contributing factors. The results of one-way ANOVA indicated that the companies significantly differed in mean of accident causes ($F_{(8,348)} = 7.62$, $P < 0.001$) and all factors except inappropriate planning for

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Table 2: Results of exploratory factor analysis

Item	Loadings	Eigenvalue	Variance explained (%)	Cumulative variance explained (%)	α
Factor 1: hazardous individual condition/state					
Negligence and failure of the personnel to perform job duties	0.52	29062	6.62	6.62	0.87
Being proud	0.59				
Bad and unsafe work habits	0.72				
Carelessness at work	0.71				
Negligence during the work	0.74				
Distraction during work	0.65				
Staff violations of safety rules	0.49				
Nervousness and quick tempered	0.46				
Inexperience or low experience of workers	0.46				
Factor 2: unsafe acts					
Deficiency of safety regulations	0.41	4.29	6.16	12.79	0.90
Unsafe transportation, arrangement, and storage of chemicals	0.41				
To carry out the task without the use of personal protective equipment	0.48				
Having bad behavior or doing indulge with someone during the work	0.50				
The use of unsafe equipment	0.70				
Working with equipment in unsafe ways	0.77				
Inappropriate arrangement and layout of tools, equipment, and objects	0.59				
Having unsafe posture during work	0.65				
Making safety devices and guards disable	0.67				
Factor 3: unsafe conditions					
No guards or inadequate guards	0.41	3.72	5.85	18.65	0.88
Unsafe working surfaces	0.46				
Poor lighting at work	0.56				
Unsafe work task or work process	0.53				
Too much noise in the workplace	0.76				
Poorly ventilated workplace	0.79				
Bad thermal conditions at work (high heat or cold)	0.75				
Inadequate labeling and warning systems about safety	0.47				
Factor 4: lack of organizing and support for safety					
Lack of occupational health and safety management system	0.47	2.98	5.14	23.78	0.86
Low awareness of managers and supervisors about safety	0.53				
Not providing necessary financial resources for safety	0.59				
Unsafe equipment	0.51				
Lack of organizational commitment	0.63				
Lack of appropriate instruction in the workplace	0.58				
Procrastination and delay in performing the task on time	0.55				
Inexperience or poor experience of managers	0.57				
Factor 5: inappropriate risk management					
Inappropriate and insufficient hazard identification	0.68	2.35	3.51	27.30	0.83
Inappropriate risk assessment	0.61				
Poor control of risks	0.71				
Inadequate supply of personal protective equipment by the factory	0.44				
Inadequate training of personnel in the field of their job duties	0.50				
Factor 6: lack of management commitment to safety					
Pressure for more production	0.44	2.24	3.51	30.80	0.75
Lack of senior management commitment	0.67				
Lack of proper system for the selection of personnel for work	0.45				
Poor safety attitude of management	0.61				

Contd..

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Table 2: Contd..

Item	Loadings	Eigenvalue	Variance explained (%)	Cumulative variance explained (%)	α
Factor 7: inappropriate planning for safety					
Unrealistic and inappropriate of job scheduling	0.40	1.94	3.40	34.20	0.76
Improper operation and process control	0.65				
Inappropriate occupational accident investigation In order to prevent their reoccurrence	0.49				
Inappropriate audit	0.65				
Bad/poor communication within the organization such as formal and informal communication among staff	0.43				
Factor 8: societal factors					
Society's economic conditions such as inflation rate	0.70	1.73	3.30	37.50	0.81
Society's political situation	0.72				
Social conditions such as unemployment levels	0.78				
The dominant culture in society	0.71				
Factor 9: lack of inspection and enforcement					
Poor external communication of organization (communication with governmental agencies regarding safety such as department of labor)	0.42	1.60	3.12	40.63	0.77
Inappropriate and insufficient safety inspection of authorities	0.71				
Lack of enforcement to guarantee the implementation of laws, regulations, and safety standards in the country	0.69				
The weakness of labor inspectors	0.73				
Factor 10: inappropriate performance					
Inadequate information sharing	0.49	1.57	3.11	43.74	0.81
To carry out the task without a permit	0.68				
Doing the task with unsafe speed	0.66				
Doing the task with wrong instruction	0.54				
Failure to report hazards	0.41				
Factor 11: inappropriate safety procedures					
Lack of encouragement for plants have a high safety level by authorities	0.54	1.52	2.54	46.27	0.68
Ineffective implementation of safety rules	0.43				
Inappropriate policies/procedures and operating standard	0.46				
Factor 12: lack of cooperation					
Improper design of workstations	0.40	1.48	2.53	48.81	0.71
Inadequate inspection of workplace by safety unit	0.61				
Poor cooperation between staff	0.45				
Factor 13: lack of staff abilities					
Accident proneness of individuals	0.64	1.40	2.32	51.13	0.81
Low motivation of staff in the workplace	0.52				
Unconsciousness of individuals at work	0.52				
Lack of skills for doing work	0.49				
Factor 14: lack of competency					
Workers without valid work certificate	0.74	1.34	2.30	53.43	0.70
Lower educated workers	0.73				
Low awareness of workers about safety	0.43				
Total					0.87

safety ($F_{(8,348)} = 1.53$, $P > 0.05$). Age groups also significantly differed in lack of staff abilities ($F_{(2,260)} = 3.43$, $P < 0.05$).

Respondents who had temporary contract with the companies reported a higher level of unsafe acts ($t_{(355)} = -2.15$, $P < 0.05$), inappropriate risk management ($t_{(355)} = -3.12$, $P < 0.001$), inappropriate safety procedures ($t_{(355)} = -2.09$, $P < 0.05$), and lack of cooperation ($t_{(355)} = -2.32$, $P < 0.05$) than participants who worked permanently in the companies. Participants who worked in the companies which had OHSAS 18001-certification reported a higher scores for lack of organizing and support for safety ($t_{(355)} = 2.47$, $P < 0.05$), inappropriate risk management ($t_{(355)} = 2.08$, $P < 0.05$), lack of management commitment to safety ($t_{(355)} = 2.57$, $P < 0.001$), and lack of competency ($t_{(355)} = 2.64$, $P < 0.001$) than other respondents. The employees who received safety training reported a higher score for lack of

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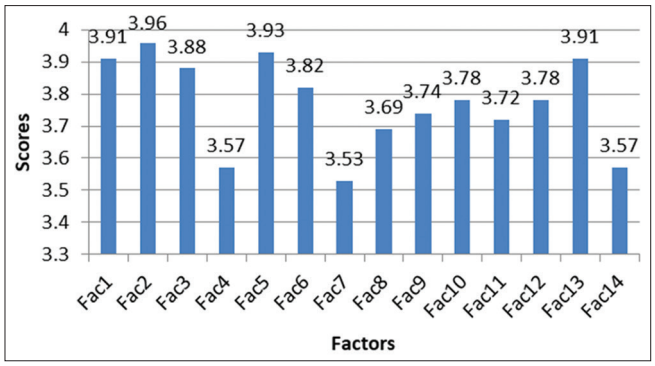

Figure 1: Accident causes in the manufacturing companies. Fac: Factor [factors were described in Table 2]

management commitment to safety ($t_{(355)} = 2.15$, $P < 0.05$). The participants who had more tenure at work experienced more occupational accidents than the respondents who had less experience ($t_{(116)} = 2.08$, $P < 0.05$). The respondents who had more education ($t_{(241)} = -2.50$, $P < 0.001$) and received safety training ($t_{(241)} = -3.02$, $P < 0.05$) experienced fewer occupational accidents than other respondents [Table 4].

Discussion

The current study was intended to find significant causes of occupational accidents. The findings from EFA revealed that 14 contributing factors influence the occurrence of accidents in the companies. The CFA indicated that all 14 latent variables adequately impact the occurrence of accidents. The identified factors were related to employees, their jobs, and organizations, and the external environment was in line with the findings of previous studies.[5,7,13,17] Rasmussen and Suedung stated that root causes of accidents emerged from outside of an organization, affecting other layers of protection inside a company such as organizational factors and actions of front-line employees, and ultimately result in the occurrence of accidents.[7] Independent consideration of these factors will not necessarily lead to control of accidents. Therefore, having a comprehensive approach and taking into account all factors can prevent the occurrence of accidents in the companies.

The results showed that unsafe acts had the highest and inappropriate planning for safety had the lowest scores. Many researchers have explained that unsafe acts are the main contributing causes of accidents.[26-28] Unsafe behaviors are usually performed by personnel having different responsibilities within an organization such as top managers, supervisors, and workers. Because frontline workers perform their activities adjacent to work processes and their unsafe acts directly affect the occurrence of accidents, these actions are too much highlighted in organizations, and their unsafe acts are considered to play a major role in creating accidents. Due to the fundamental role of managers in decision-making and their impact on the safety performance of an organization, the influence of managers on committing unsafe acts by the frontline workers is essential. This issue was confirmed by previous researchers that found several factors influence employees to act in an unwanted way that results in undesirable events. The managers of workplaces play a fundamental role in the reduction of unsafe acts conducted by employees.[29] Seo found that managerial and organizational factors such as management commitment, safety involvement, and work pressure influence unsafe work behavior.[30] The behavior of employees in workplaces may be affected by received theoretical and practical training regarding their work activities and their safety. If these trainings are effective, the unsafe acts of the people and the probability of their participation in accidents are reduced. The lowest score of inappropriate planning for safety may result from inadequate awareness of participants regarding safety planning or the importance of it for improving safety. The findings of the current study and

Table 3: Model relationships

Path	Path coefficients	SE	*t*	*P*
Outside environment (external) to				
Organizational-managerial	0.48	0.37	12.91	<0.001
Individual factors	0.10	0.37	2.61	<0.001
Organizational-managerial to				
Individual factors	0.70	0.43	16.21	<0.001
Individual factors to				
Accident	−0.30	0.42	−0.65	>0.05

SE: Standard error

Table 4: Associations between accident experience and variables

Variable	Accident experience	*n*	Mean±SD	*t*	*P*
Age	Yes	116	37.46±7.95	0.76	0.44
	No	241	36.83±7.05		
Experience	Yes	116	13.65±6.28	2.08	0.03
	No	241	12.16±6.33		
Job experience	Yes	116	10.03±6.20	1.10	0.27
	No	241	9.24±6.32		
Marriage	Yes	116	1.91±0.28	0.16	0.87
	No	241	1.91±0.29		
Education	Yes	116	4.21±0.86	−2.50	0.01
	No	241	4.44±0.79		
Job	Yes	116	1.89±1.21	−1.70	0.10
	No	241	2.13±1.33		
Job level	Yes	116	1.10±0.31	−1.04	0.32
	No	241	1.14±0.35		
Workplace	Yes	116	4.97±2.93	−0.54	0.58
	No	241	5.15±2.78		
Certification	Yes	116	1.20±0.41	−0.012	0.99
	No	241	1.21±0.41		
Safety training	Yes	116	1.31±0.46	−3.02	0.003
	No	241	1.47±0.50		

SD: Standard deviation

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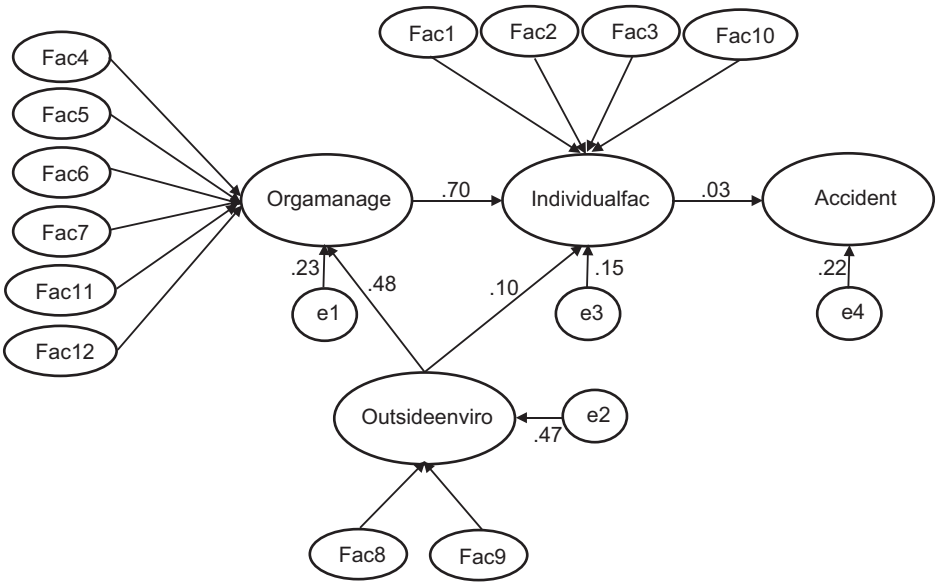

Figure 2: Proposed model. Outsideenviro: Outside environment (external), Orgamanage: Organizational and managerial factor, Individualfac: Individual factor

other studies indicated that most of the personnel employed in Iran's manufacturing companies have inadequately trained about safety, and therefore, they will not have a good safety awareness.[31-34]

The participants who had the temporary contract with the companies reported that unsafe acts, inappropriate planning for safety, inappropriate safety procedures, and lack of cooperation had more impact on the occurrence of accidents compared with the people who worked permanently in the companies. Many studies have found that temporary workers experienced more occupational injuries as compared to permanent peers. The identified reasons for this phenomenon are greater exposure of temporary workers with adverse physical and psychosocial hazards, receiving less safety training, and less experience of them for doing the responsible jobs.[35-39] Likewise, job insecurity of temporary employees can increase the probability of experiencing accidents during their works.[40] Differences in the views of participants with temporary recruitment and others can be due to unequal opportunities and attentions were given to them that create different conditions for them in workplaces.

The respondents who worked in the companies that certified based on the requirements of the OHSAS 18001 standard reported that lack of organizing for safety, inappropriate risk management, lack of management commitment to safety, and lack of competency significantly impact the occurrence of accidents compared with other participants. There are contradictory findings regarding the effect of safety management systems on the occupational injury. Robson *et al*. in their systematic review did not make a clear conclusion about the effect of the systems on decreasing occupational injury.[41] Bottani *et al*. found that the companies with safety management systems experienced lower ARs.[42] Albeit, the degree of development of the system is an important factor that impacts reducing the number of injuries.[43] However, Ghahramani and Summala found that occupational injures positively decreased in one out of three OHSAS 18001-certified manufacturing companies in Iran.[44] Therefore, it is rational that the participants from the OHSAS 18001-certified companies have different attitudes toward the occurrence of the accidents and report various influencing factors contributed to the accidents comparing other participants.

The participants who had higher education and received safety training experienced fewer accidents compared with other respondents. This finding match with those observed in earlier studies that training of safety to employees can increase their awareness about job hazards and associated risks, empower them to have more skills to do their jobs in a safe manner, and ultimately can lead to a decrease in adverse events associated with their jobs.[45,46] Alongside this, Breslin *et al*. found that the education of employees has an inverse relationship with work injury.[47] Therefore, the positive impact of the high-quality training on safety; making changes in attitudes of workers, and the reduction of their occupational accidents are reasonable.

Safety training as a key component of a safety program plays an important role in reducing accidents. It has a positive effect on the knowledge, attitude, beliefs, behavior, and empowerment of the workforce to actively make changes and promoting safety culture.[48-50] Albeit the systematic review of Robson *et al*. was unable to make a clear conclusion about the effectiveness of safety training on the enhancement of knowledge, attitude, and OHS outcomes.[41] The companies should provide training courses for all personnel by considering their needs and transfer required safety information to workers in different occupations

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through safety managers and supervisors to decrease the number of unsafe acts.

The respondents who had more job tenure had experienced more accidents. Employees usually gain more knowledge and skills regarding their occupation; they learn about safety risks and control measures of their work activities as they gain more experience in their job. Hence, they are expected to experience fewer occupational accidents. However, the finding of this study is in contrast with the findings from previous research that found employees with shorter job tenure, experience a higher percentage of injuries than those with longer job tenures.[47,51] Possible reasons for this finding can be due to low awareness among workers about safety risks and their lack of learning from experiences.

The present study indicated that all companies differed significantly in the mean of accident causes and the derived factors except inappropriate planning for safety. Because the studied companies have different safety culture and work processes with various inherent safety hazards, several causes can contribute to the occurrence of accidents. Therefore, it is obvious that their employees and the participants have a different view on the occurrence of accidents. In addition, comparing the companies based on their ARs showed that company 6 had the highest AR and AR5, but the companies 4 and 8 had the lowest AR5 and AR, respectively. It is evident that different industries and workplaces have different levels of inherent risks due to the different job activities; people who work in the workplaces have different levels of exposure to hazards, and the companies use various approaches to manage safety issues. Thus, it is logical that the companies have different injury rates.

The current study also found that individual factors had a higher score than organizational-managerial and external factors. There was no systemic attitude toward the occurrence of accidents due to the traditional nature of safety management in most of the companies, thus the majority of the accidents are attributed to the failure of front-line employees who are directly involved in their occurrence. This could be a possible reason for the participants' attitude toward the occurrence of accidents. In such workplaces, actions of the involved employees in accidents are introduced as the reason and blamed. But the review of safety literature shows that the occurrence of accidents is rooted in the organizational and management factors that lead to the creation of accidents for front-line employees.[52,53] Other studies also emphasized the role of organizational and managerial factors that identified them as important determinants of OHS and related to lower injury rates in workplaces.[46] For instance, a better safety climate was significantly correlated with lower injury rates in organizations.[54] The findings also revealed that the organizational-managerial factor has a larger impact on external factors on individual factors. Employees spend more time in organizations and their safety behavior is shaped over time, but the external factors do not have a direct impact on the behavior of workers. This finding is in line with the findings of previous studies, such as Rasmussen and Suedung, which highlights the impact of different factors from inside and outside of organizations on the occurrence of accidents,[7] as well as the safety principles that stated safety requires upstream efforts.[55]

This study was performed in the companies located in the northwest of Iran, so the findings can be generalized to manufacturing companies in the studied area. The limitations of this study include the following: it was difficult to find companies willing to cooperate in conducting this research. It was also difficult to convince workers to participate in this study because of their low awareness about safety researches and imagining lack of belief about the direct impact of this kind of research on their job status and safety. A cross-sectional study design and collecting data using a questionnaire were other limitations of the present study.

Conclusion

This study investigated the underlying causes of accidents from the viewpoints of employees who have a reliable knowledge regarding their work environments. Managers of the companies should pay special attention to the identified factors in the management of safety issues and do enough efforts to prevent probable accidents considering the findings of this study. Attention to behaviors of the employees, especially those who had a temporary contract with the companies and providing safety training to control their unsafe acts can be beneficial in reducing their accidents. Bearing in mind the high effect of organizational-managerial factors on individual factors compared with external factors, managers of the companies should take the necessary steps to control the relevant factors. It seems that considering the identified factors in the safety management process will lead to better resource allocation and improvements in workplace safety.

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Conflicts of interest

There are no conflicts of interest.

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