Archives of Occupational Health | Volume 3 | Issue 1 | January 2019 | 291-8.

Original

An Investigation of the Attitudes of Health & Safety Personnel toward Safety in Construction Projects

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Abstract

Background: With the development of technology and its increased use, potential dangers in industrial environments has increased. The purpose of this study was to evaluate the attitudes of the Fajr Institute's Health & Safety Executive (HSE) personnel toward safety. **Method:** The study population consisted of HSE staff (n: 39). Data gathering tool in this descriptive-analytical study was a researcher-developed, 30-item questionnaire with acceptable validity (1.9) and reliability (0.87). Data were analyzed using the SPSS 19. Samples were selected by census sampling and the entire study population was studied. Statistical methods used were mean, variance, standard deviation, t-test, Pearson's correlation coefficient, and factor analysis. **Result:** The average age of the participants was 28.6 years, 56.5% of them were single and 43.5% married. The average work experience of the participants was 5.2 years. Bachelor's degree (54%) and Master's degree (23%) were the most and least frequent academic degrees, respectively. The Pearson correlation coefficients showed age and work experience were not correlated with safety attitudes. The t-test results showed there was a significant difference between the viewpoints of single and married workers and attitude variable (P<0.01).The t-test results also showed there was no significant difference between education level and attitude. **Conclusion:** According to the factor analysis results, items were classified into four categories: management factors, educational factors, communication factors, and regulatory factors.

Key words: Safety; attitude; Factor analysis; Health & Safety Executive personnel

Introduction

The expanding spectrum of development projects across Iran has made the safety issues more prominent than before. Working in development projects is associated with the high potential of safety-related accidents due to the diversity of work, the presence of different working groups and the lack of familiarity with the working environment and conditions. Therefore, paying attention to safety issues in projects is of great importance.[1] Occupational safety behaviors are very important in terms of association with occupational accidents. Occupational accidents, which often occur due to human error and unsafe behaviors, impose heavy costs on the community.

Citation: Ghorbani A, Soltanzadeh A. **An investigation of the attitudes of health & safety personnel toward safety in construction projects.** Archives of Occupational Health. 2019; 3(1): 291-8.

Article History: Received: 29 Agust 2018; Revised: 11 November 2018; Accepted: 25 November 2018

In 2009 in the United States, 5734 occupational accidents resulting in death and 4 million ones leading to injuries were registered. In Europe, one occupational injury occurs every second, and one occupational accident occurs every 2 hours.[2]

Working environments, with many machines and tools, often expose workers to different hazards. With the development of technology and its increased use, potential dangers in industrial environments has increased.

Factory accidents may cause injury or death in employees that cannot be compensated for easily and quickly, and for an organization, the absence of an expert whose training has taken a great deal of time and capital is considered a huge loss.[3] Safety is one of the most widely used words related to humans and in areas such as medicine and industry. Safety is a branch of science that analyzes risk factors and addresses the strategies for their control and reduction. Safety is the rate or degree of being far from risk.[4] According to the International Labor Organization (ILO), about one third of the deaths from work occur due to accidents.[5] One of the factors affecting employees' safety behaviors is their attitudes.

Regarding the purpose of our research, which is to investigate the attitudes of Health & Safety Executive (HSE) personnel toward safety, in addition to designing an appropriate model of attitude, it is also necessary to ensure that its structural elements are accurate, and because the attitudes of the affected individuals are influenced by their mental and neurological states, it is necessary to take certain measures to create a favorable psychological environment that enables respondents to give their comments without positive or negative biases when gathering data. Attitude refers to stable systems of positive and negative evaluations, emotions and consenting and opposing tendencies toward social goals.[6] In other words, the attitude toward a certain behavior is the intrinsic (invisible) predisposition and tendency toward doing that behavior and plays an important role in changing safety behaviors. In other words, attitudes determine the type of behavior and education plays an effective role in changing attitudes.[7] One of the main issues in social psychology involves the priority of attitude over behavior or, conversely, the priority of behavior based on attitude. In the social sciences, the Theory of Reasoned Action (ToRA) explains the relationship between people's attitudes and their behaviors. The ToRA was first introduced by Ajzen and Fishbein in 1980. This theory states that behavior is best predicted by individual goals that are in turn influenced by attitudes.[8]

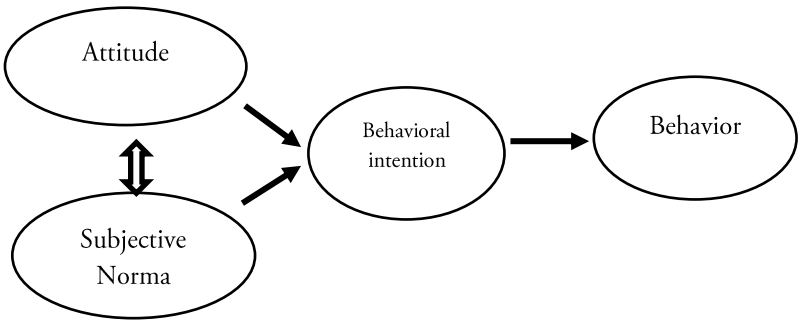

Figure 1. Relationship between attitude and behavior according to the Theory of Reasoned Action[9]

According to Figure 1, there are two independent and mobile factors beyond behavioral intention, one of which is a personal factor, namely, attitude toward behavior, referring to the degree to which a person has a desirable or undesirable attitude to the behavior in question. The more positive the attitude to a certain behavior, the more likely that behavior to occur. The second predictor of intention is the subjective norm, which, as a social factor, refers to perceived social pressure for doing or not doing a behavior.[9]

Some studies have been conducted on safety attitudes. A study showed there was not any significant correlation between age, marital status, history and safety attitude.[10]

The study of Vaziri et al[11] showed there was no significant relationship between work experience, marital status and safety attitude, but there was a significant relationship between education level and safety attitude. A study also indicated there was a correlation between the amount of wages and work experience, and safety attitude, and no correlation between other characteristics (age, marital status and education) and safety attitude[12]. The study showed that gender, marital status and work experience did not affect the attitude to occupational safety and health[13]. Wang et al presented a qualitative assessment methodology including a cluster analysis to evaluate different safety strategies.

In their methodology, they used and studied over one hundred safety projects, and then used these strategies to establish a relationship between the rates of casualties and accidents in drivers, motorcyclists and pedestrians. They observed the managerial and preventive factors were much more important to road safety[14]. The current research was conducted to investigate the relationship between personnel's individual characteristics and safety attitudes, in addition to examining the individual characteristics. The projects of the Fajr Institute are located in different regions across Iran. These projects include Shiraz Water Supply Tunnel Project, Yasouj Tang-e-Sorkh Dam project, Kazeroun Nargesi Dam Project, Firoozabad Haighar Concrete Dam Project, Yazd-Eghlid Railway Line Project, Shiraz Arjan Plain Road Construction Project and Tehran South By-Passage Project.

Methods

The current research is of descriptive type, and since this research can be applied, it is also of an applied type. The study population consisted of personnel (n: 39) employed in Fajr Institute projects. Samples were selected by census sampling, and all members of the study population were enrolled. The data collection tool was a researcher-developed questionnaire, which included items about attitude rated on a 5-point Likert scale from Absolutely disagree to Absolutely agree (1-5).The number of items of this questionnaire, which address safety attitudes in development projects, is 30. A number of professors were requested to comment on the validity of the research tool (1.9).

To determine reliability, Cronbach's alpha coefficient was calculated at 0.87, which is acceptable, by the SPSS 19. Cronbach's alpha or reliability is used for a questionnaire with items rated on a Likert scale or multiple-choice items. The SPSS version 19 was used to carry out data analysis. The significance level in this study was considered to be 0.01 and 0.05. The statistical tests used in this study were t-test and Pearson correlation coefficient. In this study, factor analysis was used to summarize the items on attitudes.

This method is to achieve two main objectives, first of which is to identify the underlying factors of variables. In this study, Bartlett's Test and Kaiser-Meyer-Olkin Test were used to identify the appropriate data. If the KMO coefficient value is above 0.500, then factor analysis can be safely used.

Results

1- Demographic characteristics:

The data of this study were of two types, descriptive and inferential, and which were analyzed by SPSS 19. First, descriptive results are presented. Then, participants' demographic characteristics are presented in a table. The study population of this study consisted of 39 Fajr Institute's HSE personnel. Sampling was done by census. The average age of personnel was 28.6 (range: 22-37) years. The results also showed the average work experience of Fajr Institute's HSE personnel was 5.2 (range: 1-12) years Table 1. According to the results, 22 (56.5%) experts were single and 17 (43.5%) married Table 2. Nine (23%) personnel had associate's degree, 21 (54%) bachelor's degree, and 9 (23%) master's degree. Fourteen (36%) had a safety-related (industrial safety, safety inspection, technical protection, and HSE) certificate and 25 (64%) did not Table 3.

2- Prioritizing safety items:

In order to investigate the safety attitudes of HSE personnel, a 30-item questionnaire was used. The items are rated on a 5-point Likert scale (Absolutely disagree= 1, Disagree=2, No idea=3, Agree=4 and Absolutely disagree=5).

To prioritize the items, coefficient of variation (CV) was used.

The prioritization of the items is shown in Table 4. As shown, gaining knowledge about personal protective equipment, the use of appropriate work tools, and working safely at all work hours were the first, second and third priorities, respectively.

3. Inferential results

The results indicated that the average response rate of personnel to items related to safety Attitudes was 4.052.

The Pearson correlation coefficient between two variables, age and attitude, and the variable safety attitude showed the two variables were not significantly correlated with safety attitudes.

The results also showed a significant relationship between work unit and safety attitude (P<0.01) Table 5.

The t-test results showed there was a significant difference between the viewpoints of single and married personnel regarding safety attitudes (P<0.01), so that single personnel had an average response rate of 4.114 and married personnel an average response rate of 4.029 Table 6.

The t-test results showed there was no significant relationship between the independent variable education level and the dependent variable safety attitude Table 7.

Table 1. Individual and demographic characteristics of participants

		Age	Marital status	work pertinence	Education level
N	Valid	39	39	39	39
	Missing	0	0	0	0
Mean		28.68	1.72	5.20	2.25
Mode		35.00	2.00	15.00	2.00
Std. Deviation		8.19	0.44	6.82	1.17
Variance		67.14	0.20	46.62	1.392
Minimum		22.00	1.00	1.00	1.00
Maximum		37.00	2.00	12.00	3.00

Table 2. Respondents' marital status

Variable		Specifications
Marital status	single	22 (56.5%)
	Married	17 (43.5%)

Table 3. Respondents' education level

Education level	Bachelor's degree	21 (54%)
	Master's degree	16 (41%)
	Doctoral degree	2 (5%)
	Relevant	14 (36%)
	Irrelevant	25 (64%)

Table 4. Prioritization of items pertaining to safety attitudes

Items on Employees' Safety Attitudes	Mode	Variance	Std. Deviation	Mean	CV	Rank
Being knowledgeable about the personal protective equipment	5	0.33	0.579	4.50	0.128	1
Using appropriate tools	4	0.39	0.626	4.40	0.142	2
Paying attention to work safety at all work hours	5	0.40	0.638	4.39	0.145	3
Hiring safety personnel in all projects	5	0.50	0.711	4.38	0.162	4
Constantly observing safety issues	5	0.53	0.731	4.37	0.167	5
Codifying occupational regulations for all personnel	5	0.56	0.754	4.37	0.172	6
Working safely has a great impact on co-workers	5	0.60	0.779	4.31	0.180	7

Table 5. Pearson Correlation Coefficients between independent variables and safety attitude

Variable	Correlation coefficient (r)	Significance level (*P*)
Age	0.062 ns	0.249
Work experience	0.049 ns	0.596
Occupational unit	0.258**	0.004

* P<0.05, ** P<0.01, ns: non-significant

Table 6. Comparison of independent variable marital status and dependent variable safety attitude

Significance level (P<0.001)	Statistical test	Standard deviation	Mean	Group	Variable
**0.001	t	0.337	4.114	Single	Marital status
		0.381	4.029	Married	

** P<0.001

Table 7. Comparison of independent variable education level and dependent variable safety attitude

Significance level (P)	Statistical test	Standard deviation	Mean	Group	Variable
0.185^{ns}	t	0.370	4.052	University education	Education level
		0.388	4.112	No university education	

Non-significant

4. Factor analysis

In this study, a 30-item questionnaire was used to investigate the safety attitudes of an HSE's personnel. In this phase, factor analysis was used to categorize the items into few main factors.

Factor analysis is considered to be the quintessence of analytical methods due to its robustness, precision and proximity to the core of the scientific goal.

This method pursues two main objectives, first of which is to identify the underlying factors of variables. In this regard, the common feature of the variables is identified by the common variance and then is labelled by the researcher.

The second goal of the factor analysis is to identify relationships between new variables (factors), which is, however, less important.

Despite the capability of this method in analyzing data, it is not possible to use it in any conditions. The data that fulfill necessary fitness indices to be analyzed by factor analysis are suitable for this analysis[15].

In this study, Bartlett's and Kaiser-Meyer-Olkin tests were used to identify the appropriate data. If the KMO value is above 0.500, then factor analysis can be safely used.

According to Table (8), the KMO coefficient in our study was obtained 0.806, which is appropriate. Bartlett's test of sphericity (X2) was obtained 1512.553, which was statistically significant (*P*<0.01, sig=0.000).

Figure 2 illustrates variance in the values of the factors. This figure is used to determine the optimal number of components.

As illustrated, after the fourth factor, the variance in the values decreased, so that three factors can be considered important factors that play the most substantial role in explaining the variance in the data.

Table 8. Calculation of fitness of research data

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.806
Bartlett's Test of Sphericity	Approx. Chi-Square	1512.553
	df	435
	Sig.	.000

After the suitability of the data for factor analysis was assured, Verimax rotation was used to identify significant factors.

The number of factors was pre-determined based on specific values. Factors drawn are listed in Table 9.

As illustrated, the 30 items are classified into four factors, i.e., management, educational, communication, and regulatory. After the Varimax rotation, based on the identification of the variables with factor load over 0.5, they are presented in the table. In this table, the variables whose factor load were less than 0.5 were excluded due to their negligible significance.

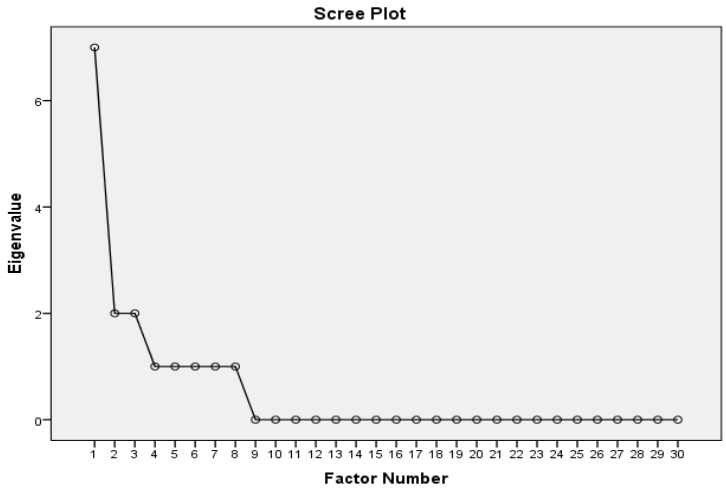

Figure 2. The scary graph of factors' number determination

Table 9. Variables related to each of the factors drawn from Varimax rotation

Row	Specific value	Item	Load
Management factor	3.764	Being knowledgeable about personal protective equipment	0.503
		Holding in-service training courses	0.633
		Being knowledgeable about work tools	0.514
		Preventing accidents	0.591
		Using dexterous manpower	0.538
		Incidence of occupational accidents at work	0.743
		Mastering fire extinguishers	0.656
Communication factor	3.630	The relevance of the work of colleagues to my work	0.683
		Thinking about occupational safety at work	0.728
		Sharing opinions with colleagues	0.517
		Reporting unsafe working conditions	0.511
		Believing in the impracticality of the rules	0.504
		Believing in the likelihood of being affected by an accident	0.625
Cognitive factor	3.323	Safe work is worth spending time	0.598
		Being interested in recognizing risks	0.723
		Understanding job duties and responsibilities	0.677
		Influence of focusing on preventing accidents	0.611
		The impact of focus on accident prevention	0.556
		Being familiarized with the signs	0.543
Regulatory factor	2.640	Personnel's familiarization with emergency conditions	0.698
		Working safely at all work hours	0.589
		The influence of safety personnel's dealings with other colleagues	0.662
		Assuming the personnel as safety assistant	0.665
		Constantly observing safety issues	0.592
		Agreeing to establish safety in all areas	0.597

Discussion

The results showed that the average response rate of HSE personnel to items related to safety attitude was 4.052. The Pearson correlation coefficient between age and safety attitude showed there was not any significant relationship between these two variables, which is consistent with the studies of Khalafi et al. (1392), and Vaziri et al. (2014).

The results also showed that there was no significant relationship between the independent variable work experience and the dependent variable safety attitude, which is in agreement with the study of Hosseini Nodeh et al. (2012) but is inconsistent with the study of Vaziri et al. (2014). The results also showed there was a significant relationship between the work unit variable and attitude (P<0.01). The reason for this finding is the interest in the job and its suitability to the individual needs of the personnel.The t-test results showed there was a significant difference between the viewpoints of single and married personnel regarding safety attitudes (P<0.01), so that so that single personnel had an average response rate of 4.114 and married personnel an average response rate of 4.029.These results are inconsistent with the studies of Hosseini Nodeh et al. (2012) and Malekpour et al. (2012). One of the reasons that can affect gender-based differences in safety attitudes can be the fact that married people are more committed to themselves and the family and they are obliged to observe safety laws and regulations, and therefore returning home healthy is essential to them.

The t-test results also showed there was no significant relationship between the personnel's education level and safety attitudes, which is inconsistent with the study of Vaziri et al. (1393) but in agreement with the study of Hosseini Nodeh et al. (2012). The factor analysis results showed that safety-related items fall into four factors: communication factors, management factors, educational factors and regulatory factors. These results are consistent with the study of Wang et al. (2004).

Conclusion

Given that the spectrum of the activities of the industries and projects is very wide, more research is needed in this regard. In conclusion, according to the findings of the present research, some suggestions can be offered, including:

1- Promoting employees' culture by holding training courses for them;
2- Hiring personnel who fulfill appropriate qualifications for each job;
3- Constantly updating knowledge and information appropriate for each work unit;
4. Creating conditions to identify and visit safe companies;
5- Explaining the risks of each job for personnel;
6. Familiarizing the personnel with their respective occupational regulations further; and
7. Participating and debriefing in managerial meetings to create better working conditions for personnel.

Conflict of interest

The authors did not report any contradiction of interests.

Acknowledgments

I would like to thank of Dr. Ahmad Soltanzadeh and all those who helped us in this study.

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