

# Analysis of Occupational Accident Fatalities and Injuries Among Male Group in Iran Between 2008 and 2012

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## Abstract

**Background:** Because of occupational accidents, permanent disabilities and deaths occur and economic and workday losses emerge.

**Objectives:** The purpose of the present study was to investigate the factors responsible for occupational accidents occurred in Iran.

**Patients and Methods:** The current study analyzed 1464 occupational accidents recorded by the Ministry of Labor and Social Affairs' offices in Iran during 2008 - 2012. At first, general understanding of accidents was obtained using descriptive statistics. Afterwards, the chi-square test and Cramer's V statistic (Vc) were used to determine the association between factors influencing the type of injury as occupational accident outcomes.

**Results:** There was no significant association between marital status and time of day with the type of injury. However, activity sector, cause of accident, victim's education, age of victim and victim's experience were significantly associated with the type of injury.

**Conclusions:** Successful accident prevention relies largely on knowledge about the causes of accidents. In any accident control activity, particularly in occupational accidents, correctly identifying high-risk groups and factors influencing accidents is the key to successful interventions. Results of this study can cause to increase accident awareness and enable workplace's management to select and prioritize problem areas and safety system weakness in workplaces.

**Keywords:** Occupational, Accident Analysis, Accident Causes, Injury, Fatality

## 1. Background

According to the International Labor Organization, approximately two million people die while at work every year. Hamalainen et al. estimated that there were approximately 350,000 fatal occupational accidents and 264 million nonfatal work-related accidents around the world in 1998 (1, 2). Occupational accidents have a major impact on human integrity, but they also bring about high costs for a country's social security system and cause large levels of absenteeism and low productivity (3). Because of occupational accidents, permanent disabilities and deaths occur and economic and workday losses emerge. In particular, the death of workers or their permanent disability leads to negative economic loss and social problems for employers, employees and their families. Occupational accidents can be reduced by attaching importance to this issue and by taking effective preventive measures. Employers, workers, trade unions and related state authorities can be considered as the individuals and institutions responsible for determining the outcomes of this issue. Because of effective planning of prevention measures, the occupational accidents in developing countries are significantly higher than in developed countries (1, 4). The safety manage-

ment decisions that must be made to select and prioritize problem areas and safety system weaknesses must be based on the recognition of hazards encountered in each activity (5).

Among the greatest concerns of occupational safety researchers, it is to understand the causes that produce accidents. Thus, studies have been conducted into such aspects as training, overtime, the age of the worker, length of service in the firm or the incorporation of quality and safety to determine their impact on safety rates (3, 6-8). The most important factors that affect the occurrence of accidents include: (1) personnel factors (age, gender, experience); (2) environmental and equipment factors (injury source, accident type); (3) project factors (project type, contract volume); and (4) management factors (company size) (9-12).

Accident analysis is used to identify factors contributing to occupational injuries and to develop strategies for injury prevention. The analysis of aggregated accident data rather than single case analysis is considered as the only way of discovering any unifying and common factors in accident events (8). The purpose of an accident analysis is to obtain accurate, and objective information

about the causes of accidents in order to prevent the incident from recurring (13).

In Iran, the ministry of labor and social affair is responsible for writing occupational and industrial safety regulations and supervising on their implementation. The most important occupational health and safety regulations are in chapter 4 of Islamic Republic of Iran Labor Role. In Iran, all occupational accidents that cause fatality, injury or lost time should report to Ministry of labor and social affairs' offices. According to the regulations, all employers require to report occupational accidents during 72 hours after the accident occurrence. The ministry of labor and social affairs analyzes the accidents and develops a plan to prevent the recurrence.

## 2. Objectives

This study was performed to analyze the occupational accidents occurred in various economic sectors between 2008 and 2012. Consequently, some recommendations were presented to reduce and prevent occupational accidents. The purpose of the present study was to investigate the factors responsible for occupational accident occurred in Iran during 2008 - 2012.

## 3. Patients and Methods

### 3.1. Data Collection

As noted above, collecting and analyzing of occupational accidents is the responsibility of ministry of labor and social affair. This ministry records occupational accidents' information through routine documents and computerized system. According to Iran labor law, an occupational accident is defined as a situation, occurred in the work time, which leads to physical or mental harm. Employers must report the occupational accidents within three working days after it happens to the proper branch of this ministry in special forms and checklists, according to law (14). Once an employer reported an occupational accident, the experts of the local offices of this ministry went to the workplace where accident occurred and investigated it, then registered the accident data in the database.

In the present study that is a cross-sectional study, we used the accidents database of this ministry. For subject selection we had two criteria: accidents with seriously consequence or caused fatality. According to these criteria, 1464 of 4322 occupational accidents that recorded by the offices of the ministry of labor and social affair in Iran, between 2008 and 2012, were selected. Also, because of the small group of women (54 subjects), we exclude them from our study. Reports of occupational accidents have various information such as: victim's age, gender, experience, accident results, time of the accident, etc. (15). For each accident report, age, work experience, accident causes, activity sector and other relevant factors were classified into several useful categories for further analysis (4).

### 3.2. Data Classification

Occupational accident reports have various information but we extracted nine factors from occupational accident reports. One reason for selecting these nine factors was that these nine factors had complete information in the report forms and other factors information was very insufficient for our analysis. Age was classified into five categories. Work experience was classified into five different levels and victim's education was classified into six different levels. Marital status was classified into three categories of single, married and unknown. Table 1 is shown these factor's categories and occupational accidents' distribution.

An activity sector was classified into ten categories and causes of accidents according existing data were classified into seven different categories. Type of injury as accident outcome was classified into seven categories and time of accident occurrence in day was categorized into six levels. Table 2 is shown these factor's categories and occupational accidents' distribution.

**Table 1.** Distribution of Factors Influencing 1464 Occupational Accidents During 2008 - 2012<sup>a</sup>

Factor	Values	Fatality
<b>Age, y</b>		
15 - 24	508 (34.69)	7 (4.14)
25 - 34	504 (34.43)	62 (36.68)
35 - 44	254 (17.35)	47 (27.81)
45 - 54	149 (10.18)	26 (15.38)
≥ 55	49 (3.35)	27 (15.97)
<b>Work experience, y</b>		
< 1	601 (41.05)	85 (50.30)
1 - 5	388 (26.51)	44 (26.04)
5 - 10	214 (14.61)	15 (8.88)
10 - 15	96 (6.56)	8 (4.73)
> 15	165 (11.27)	17 (10.05)
<b>Victims' education</b>		
Elementary	459 (31.35)	47 (27.81)
Secondary	396 (27.05)	27 (15.97)
High school	124 (8.47)	14 (8.28)
Diploma	240 (16.4)	19 (11.24)
Academic education	28 (1.91)	2 (1.2)
Unknown	217 (14.82)	60 (35.50)
<b>Marital status</b>		
Single	564 (38.53)	84 (49.70)
Married	877 (59.9)	77 (45.57)
Unknown	23 (1.57)	8 (4.73)

<sup>a</sup>Data are presented as No. (%).

**Table 2.** Distribution of Factors (Activity Sector, Cause of Accident, Type of Injury, Time of Day, Year of Accident Occurrence) Influencing 1464 Occupational Accidents, During 2008 - 2012 <sup>a</sup>

Factor	Values	Fatality
<b>Activity sector</b>		
Construction	727 (49.73)	106 (62.71)
Manufacturing	354 (24.19)	18 (10.64)
Services	86 (5.87)	12 (7.10)
Hotel and restaurant	22 (1.52)	1 (0.6)
Mining	12 (0.83)	1 (0.6)
Agriculture, forestry and fishing	43 (2.94)	12 (7.10)
Electricity, gas and water supply	11 (0.75)	2 (1.2)
Home appliances and vehicle repairing	16 (1.1)	1 (0.6)
Business activities	29 (2)	3 (1.8)
Others	162 (11.07)	13 (7.70)
<b>Cause of accident</b>		
Equipment without safeguarding or technical failure	235 (16.05)	24 (14.20)
Victim carelessness	87 (5.95)	9 (5.33)
Non-using of PPE	15 (1.02)	5 (2.94)
Lack of training or no effective training	35 (2.39)	0
Lack of PPE	108 (7.37)	19 (11.23)
Lack of supervision	973 (66.47)	109 (64.50)
Unknown	11 (0.75)	3 (1.8)
<b>Type of injury</b>		
Injury	272 (18.58)	-
Burn	51 (3.48)	-
Fracture of bone	641 (43.79)	-
Fatality	169 (11.54)	-
Amputation	229 (15.64)	-
Poisoning	4 (0.27)	-
Others	98 (6.7)	-
<b>Time of day</b>		
1 - 4.59	23 (1.57)	4 (2.37)
5 - 8.59	65 (4.44)	9 (5.33)
9 - 12.59	699 (47.75)	76 (44.97)
13 - 16.59	451 (30.8)	45 (26.62)
17 - 20.59	202 (13.8)	31 (18.34)
21 - 0.59	24 (1.64)	4 (2.37)
<b>Year of accident occurrence</b>		
2008	210 (14.34)	24 (14)
2009	261 (17.82)	36 (21.17)
2010	383 (26.17)	40 (23.63)
2011	325 (22.21)	38 (22.62)
2012	285 (19.46)	31 (18.58)

<sup>a</sup>Data are presented as No. (%).

### 3.3. Statistical Analysis

We obtained general understanding of accidents using descriptive statistics. Afterwards, the researchers used the chi-square test and Cramer's V statistic (Vc) to analyze the association between factors influencing the type of injury as occupational accident outcome (12, 16). We used SPSS version 17.0 to analyze the data.

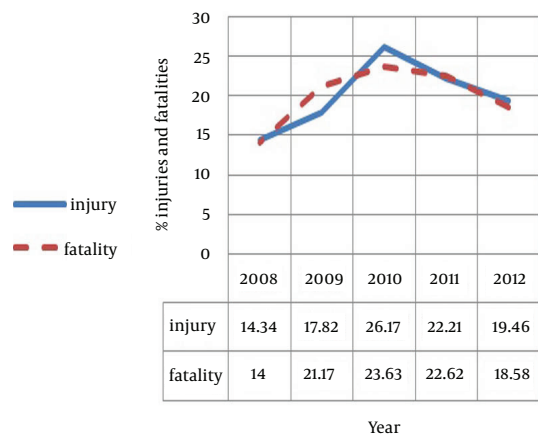
## 4. Results

### 4.1. Frequency Distribution of Variables

Tables 1, and 2 show a summary of the major findings of the analysis in terms of age group and work experience. The frequency analysis on each coded variable indicated that the majority of victims were less than 35 years old (1012, 69.12%), had less than 1 year of working experience (601, 41.05%), had less than high school education (855, 58.40%) and married (877, 59.90%) (Table 1). Additionally, construction (727, 49.73%) and manufacturing (354, 24.19%) industries account for most of the occupational accidents while the most important cause of accidents was insufficient supervising (973, 66.47%). The most common injury type was fracture of bone (641, 43.79%) and the most accidents (699, 47.75%) were occurred during 9 - 12.59 and year 2010 (383, 26.17%) (Table 2).

### 4.2. Association Among Factors

Associations among factors were revealed by the chi-square and Cramer's V test (Table 3). Marital status and time of day were not significantly associated with the type of injury. However, activity sector ( $P < 0.001$ ,  $V_c = 0.193$ ), year of accident occurrence ( $P < 0.001$ ,  $V_c = 0.169$ ), cause of the accident ( $P < 0.001$ ,  $V_c = 0.136$ ), victim's education ( $P < 0.001$ ,  $V_c = 0.119$ ), age of the victim ( $P < 0.001$ ,  $V_c = 0.110$ ) and victim's experience ( $P < 0.001$ ,  $V_c = 0.091$ ) were significantly associated with the type of injury (based on strength of association). Also, Figure 1 shows the trend of injuries and fatalities according to the year.



**Figure 1.** Trend of Injuries and Fatalities According to the Year

## 5. Discussion

This research developed a classification scheme mostly based on existing literature to categorize 1464 occupational accidents in terms of influencing factors. The result from the present study indicated that the workers involved in the most occupational accidents were the workers with the age 34 years old and below (69.12%); however, the most fatalities were in 25 - 44 years old workers (64.49%) (Table 1). This result is consistent with the findings of other studies (2, 13, 17). Younger workers, aged below 35, were represented disproportionately in the all of accidents, and it is suggested that this was caused by their inexperience and carelessness. The occupational accident rate of the group of 45 years old and above was very low and this result was in consistent with the findings of other studies (5). The reason for this may be that they are more experienced, responsible and careful. Moreover, the reason for this high occupational accident rate in the group of 34 years old and below may be due to the high employment rate in this age group (5, 18). According to Table 3, age group is significantly correlated with the type of injury.

Working experience increases with age and risky behavior in general is influenced by age. This is reflected in the rate of accidents at work (5, 19). The frequency distribution of experience seems to confirm that young workers (< 35 years old) suffer occupational accidents due to their lack of experience (4).

Several studies have suggested that new and inexperienced workers have the greatest risk of occupational accidents (20-22). In this study, the finding that most of the occupational accidents occurred during the first year of employment (41.05%) was consistent with previous findings (20). Byung study also indicated that 51.30% of all injuries occurred during the first year of employment (13). This result confirms that inexperience is related to a high accident rate.

Most accidents occurred among workers with primary and secondary education (58.40%) while, the mortality of the two groups are the most common (43.78%). One of the

reasons is the employment of these workers in industries and occupations that require a lot of exercise, and physically hard. Another reason could be their low understanding of risks due to the low level of education, lack of adequate and effective training, and lack of supervision. This factor also has a significant relationship with the type of injury (Chi = 0.034, df = 35, Vc = 0.119). Therefore, consequences of accidents can be reduced by training.

Married people account for the largest number of accidents (59.90%), while the frequency of deaths of married (49.70%) and single (45.57%) people are relatively similar. Statistically, there was no significant relationship between marital status and the type of injury. The reason of most accidents among married people can be because of their employment in many firms, hazardous tasks and hard work.

Most of the occupational accidents occurred in the sectors of construction and manufacturing in Iran between the years 2008 and 2012, respectively. According to Macedo et al. study, construction and manufacturing were the most important economic activities in terms of occupational accidents in Portugal during 1992 - 2001 (2). When the deaths connected with occupational accidents that occurred in Iran are evaluated, it is seen that the highest figure is in the construction sector (62.71%). This finding is consistent with the finding of Sinan Sut in Turkey (5). The construction sector is one of the most dangerous sectors in the United States too. In 2004, construction workers were 7.7% of the US workforce, but suffered 22.2% (1278) of the nation's reported work-related deaths (23). The construction industry in Taiwan (and elsewhere) has a very high incidence of such major occupational accidents (8, 11, 12, 21). The construction industry is dynamic, complex and hazardous due to the diverse and complex nature of work tasks, trades, and environment, as well as the temporary and transitory nature of construction workplaces and workforces. Therefore, the risk of occupational accidents in the construction industry is far greater than in a manufacturing based industry (8).

**Table 3.** Chi-Square and Cramer's V Tests for Eight Factors Against the Type of Injury

Factors	Chi-Square	Df	P Values	Cramer's V
Activity sector	3.810	63	< 0.001	0.193
Year of occurrence	1.665	28	< 0.001	0.169
Cause of accident	1.625	42	< 0.001	0.136
Victim education	1.034	35	< 0.001	0.119
Age of victim	89.014	35	< 0.001	0.110
Victim experience	85.204	49	< 0.001	0.091
Marital status	36.350	14	0.001	0.111
Time of day	57.702	35	0.017	0.085

The occupational accidents occurred mostly due to lack of supervision and equipment without safeguarding or



technical failure, respectively. One of the reasons is the wrong accident report and analysis method. Lack of supervision and equipment without safeguarding or technical failure are the accident surface cause and an expert can report them easily and without any effort.

When we look at the types of injuries that occurred because of occupational accidents, the fracture of bone (43.79%), injury (18.58%) and amputation (15.64%), respectively are the most frequently can be seen. Byung (13) study revealed that the most type of injuries in Portugal during 1992 - 2001 was fracture (37.70%) that this finding is relatively the same as our finding. Because the most important economic activity in terms of fatal accidents is construction; so, one expects that fracture of bone caused by falls from high heights would be one of the major injuries at work.

Considering the occupational accidents by hour period, can state that 9 - 12.59 hour and 13 - 16.59 hour periods were those when more accidents occurred, respectively. This finding is consistent with Macedo study that showed more accidents occurred during 8 - 12 hour and 12 - 16 hour periods (2). Other authors have treated the time of the accident as a partial aspect in their research into work-related accidents. A study on fatal falls in the US construction industry found that 76% occurred between 06:00 and 17:00 hours (24). A study of nonfatal falls in the State of Virginia found that 85% of all injuries due to falls took place between 08:00 and 16:00 hours (25). The time of an accident has also been studied in others countries, thus in Portugal, the highest accident rates occur between 8:00 and 12:00 hours (2). It has also been shown that more injuries occur in the morning in Australia than in the afternoon on every working day of the week (26). One reason for increasing accidents during these periods is the fact during 9 - 16.59 hours most enterprises are working full and similarly throughout time, whereas a major fraction of enterprises operate at night depending on client order which are not constant throughout time (2).

When we consider the accidents and their severity trends according to years of their occurrence (Table 2 and Figure 1) can state that the year 2010 was the year that the most accidents and fatalities had been occurred. With increasing the number of accidents the fatalities increased too. A certain conclusion about future trends or accidents and their severity needs more study.

This study investigated the factors influencing occupational accidents in Iran based on the 1464 collected records between 2008 and 2012. The result illustrated that the majority of victims were less than 35 years old, had less than 1 year of working experience, had less than high school education and married. Workers above 55 years old had higher percentage of fatality because most of older worker are with low education level and low mobility. The most occupational accidents occurred in the construction sector. From the result of the present study, it is found that the promotion of health and safety management for workplaces is critical (11).

Successful strategies for accident prevention will depend on effective analysis and commitment on the part of employers and cooperation by employees working together towards the elimination of actual and potential risks (13, 27). That is, the analysis of accident data can influence accident prevention programs (13).

Successful accident prevention relies largely on knowledge about the causes of accidents. In any accident control activity, particularly in occupational accidents, correctly identifying high-risk groups and factors influencing accidents is the key to success interventions (20). Although many factors affect the occupational accidents, this study analyzed nine factors such as gender differences, age groups, working experience, education and so on.

To reduce the overall occurring rate of occupational accidents in the workplaces, it is important to implement required safety practices and training effectively to insure that all workers acknowledge and follow these requirements regulations when working. The results of this study provide a framework for improving the safety practices and training programs that are essential for protecting workers (12). Prevention measures, including safe work practices, guarding, and PPE are proposed for accident prevention and employers must implement daily inspections of tools, equipment and workplaces (4).

Results should increase hazard awareness and enable workplace's management to select and prioritize problem areas and safety system weakness in workplaces. Continued reductions in accidents will require additional efforts to develop new and creative approaches to training workers, and to identify and implement interventions that address the remaining sources of risk (28).

The findings identified in this study can be used to decide on the accident prevention programs. In order to prevent or reduce the number of occupational accidents, the components causing occupational accidents should be identified via analysis, assessments, necessary measures should be taken, and audits should be used to see if the measures are implemented effectively or not. What is important here is the continuous implementation of measures and auditing. The success of preventing occupational accidents depends on this process. Accidents may be decreased if a safety culture is constituted and shared with employees (5).

Firms to learn more about the occupational accidents can use the conclusion of this research. The current research develops a classification method for occupational accidents that facilitate the categorization of occupational accidents in terms of gender differences, age groups, education, and activity sectors and so on. By understanding the distribution of fatalities, targeted efforts to reduce them will benefit all industries (29).

The findings identified in this research provide a direction for more effective inspection strategies and occupational accidents prevention programs. Proposed inspection plans should be in accordance with the type of activity sector and workplace evaluation. This article

may lead to further works discussing the causes of occupational accidents in Iran (8).

Despite the mentioned findings and their application in decision making and prevention of accidents, this study has some limitations. Researchers were not involved in data collection and used an existing database that completed by labor local offices experts. Accidents report forms did not consider confounding factors such as victim life style, culture. Additionally in accident investigation process, experts did not explain environmental conditions such as heat, humidity, rainy, windy, etc.

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## Footnotes

**Authors' Contributions:** Seyed Shamseddin Alizadeh developed the original idea, gathered the data and prepared the manuscript. Seyed Bagher Mortazavi and Mohammad Mehdi Sepehri analyzed the data.

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