Original Article

Occupational Trauma in Industrial and Mining Accidents in Iran during 2016–2017

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Abstract

Background and Objectives: Occupational diseases and accidents have been known as one of the leading causes of mortality in the world and are considered as one of the most important health, social, and economic risk factors in industrialized and developing societies. The present study aimed at investigating traumatic occupational accidents in Iranian mining and industrial sectors during 2016–2017. **Methodology:** This was a descriptive study conducted on the basis of registered data analysis from industrial and mining sector events in Iran by the relevant executive agency during a 1-year period. The collected data were analyzed using SPSS and Microsoft Excel software. **Results:** Investigating the records of accidents in the given year suggested a total of 441 accidents including 379 industrial (85.9%) and 62 mining accidents (14.1%) in Iran. In this study, the number of lost work-days was 1,585,383. Direct and indirect costs due to accidents were 638,746,428.56 (US $). The most common type of incidents included fire, falling, and caught in or between objects, respectively. **Conclusion:** Human being plays a significant role in production cycle, and the deaths associated with work-related accidents, in addition to the loss of hardware investment, may result in a loss of life, lost years of employment, and related costs. Improving employer and employees' perception of management safety practices can be important to prevent the development of job injuries and to promote workers' safety and well-being.

Keywords: Industrial accidents, mining, occupational accidents, trauma

Introduction

Nowadays, occupational diseases and accidents have been known as one of the leading causes of mortality in the world and one of the most important health, social, and economic risk factors in working community and occupational health and safety issues.[1] Over half of the world's population (58%) spend one-third of their adult lives in workplace, and thus, the economy of the community is formed.[2] According to the statistics from International Labor Organization (ILO), 374 million work incidents and illnesses occur per year, resulting in the loss of 2.78 million lives. These occupational accidents involve high social and economic costs.[3] It is also estimated that about 4% of the world's gross domestic product, or circa US $2.8 trillion, is lost annually in direct and indirect costs owing to occupational accidents and work-related diseases (International labour organization, 2014;3). The high frequency and severity of these events represent a serious problem to society and require cause for concern to improve working conditions of workers.[4] Research shows that approximately 80% of accidents are directly related to a person involved in the incident rather than an unsafe work environment. After an accident, people tend to look for someone

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or something to blame rather than identifying the root cause.[5,6] On the other hand, it should be remembered that unsafe behaviors of people in work environments are affected by various personal, occupational, and environmental factors, and without identifying these factors, it is impossible to find the causes of work-related accident.[7] It should be noted that occupational accidents are preventable. It is also essential that lessons are learned when they occur. This approach will enable organizations to take preventive action to improve working conditions, which, in turn, will lead to a reduction in the number of such accident. To learn from these incidents, effective investigations need to be conducted to determine root causes and to identify effective control measures that can be implemented to eliminate and reduce the hazard risks.[8] Unfortunately, although the accident rate is high in Iran, few studies have been published in regard to this issue from this country.[9] Occupational accident statistics are published annually in many countries, but they are not thoroughly reliable because of under-reporting.[10] Fear of deportation, losing wages and benefits, agreements between the employer and workers about repayment, unawareness of the compensation system, and the probability of rejecting the workers' claims are typical reasons for not reporting minor injuries.[11]

The study of Bakhtiyari *et al*. showed that the accidents were more frequent in metal workplaces and electrical industries, respectively. More than half of the accidents were due to incautious activities.[12] The results of Barlas and Izci's study that analyzed data related to shipyard occupational accidents and was registered in the Ministry of Labour and Social Security of Turkey showed that five major reasons for the fatal occupational accidents in this job are falling to a lower level, electric shock, fire and/or explosion, struck with and caught in between of objects, and drowning.[13] The above studies and their results emphasized the importance of accident investigation because prevention is a key reason to accident investigation, which leads to heightened safety. Investigating accidents should have an emphasis on determining the cause. Finding fault is not as beneficial as finding facts that can lead to actions. This mentality will help illuminate prevention for the future. This study aimed at investigating the epidemiological trauma of occupational accidents among Iranian industrial and mining workers during 2016–2017 with an integrated and well-supported frame work and the availability of data source and expected to raise the level of awareness toward safety and health needs at workplace.

Methodology

Type of study

This was a descriptive study based on events of industrial and mining sectors by health, safety, environment, and energy office of the Ministry of Industry, Mine and Trade (Iran) from September 2016 to September 2017.

Data collection

To collect data in accordance with the objectives of the study, a designed framework developed by the relevant organization was used which included the separation of industrial and mining events and the direct and indirect costs of accidents based on the iceberg costing model. Most experts estimate that the indirect costs are 3–10 times the direct costs of an accident.[14]

Study variables

The study variables included the number of days with and without accidents, frequency of accidents causing death, causes of accidents, number of lost working days of accidents based on tables, number of lost working days according to damage to any body organs published by the General Directorate Inspection of the Ministry of Cooperatives, Labour, and Social Welfare,[15] and the consequences of their occurrence (human, biological, and processes).

Analytical method

No entrance-and-exit criteria were included in this study and all recorded incidents were investigated. In this study, SPSS 16 for windows (Microsoft, Chicago, IL, USA) was used to analyze the collected data.

Results

The analysis of the incidents registered during the 1-year period in the study showed that, in total, 441 accidents were recorded including 379 (85.9%) industrial accidents and 62 (14.1%) mining accidents in the industrial and mining sectors throughout Iran.

The frequency of deaths over a 1-year period was a total of 186 people, of which the number in the first 6-month period was higher compared to the second 6-month period. It should be noted that the high death toll in May 2017 was due to the explosion of a mine in one of the provinces in Iran.

Table 1 shows that the number of days with accidents in the first 6 months was higher than the days without incident and the trend was decreasing at the end of the study year and the accident trend was declining from September 2016 to September 2017, though the death toll showed a reverse trend, so that the number of death was higher in 2016 compared to 2017.

Table 1 suggests that the most direct and indirect costs were reported in April, December, and March 2016.

As Figure 1 shows, the most common types of incident leading to trauma were fire, falling from height, and caught in or between objects, respectively.

Figure 2 shows a higher number of working days lost in the first 6-month period as compared to the second 6-month period, which supports the higher number of death during the period.

Table 2 shows that the most common reason to industrial accidents was unsafe conditions. Unsafe acts caused the highest number of accidents from October to December 2016.

Table 2 shows that the most frequent cause of mining accident was unsafe condition. The highest percentage of

Table 1: Frequency of occupational trauma in industrial and mining sectors during 2016-2017

Month/year	Accident frequency		Total accidents	Decease	Day with accident	Direct and indirect costs of accidents (USD)
	Mining	Industry				
September 2016	3	57	60	14	25	573,928
October 2016	4	29	33	9	16	2,071,428
November 2016	3	35	38	9	22	3,657,142
December 2016	4	31	35	11	17	15,616,785
January 2017	4	39	43	7	23	745,714
February 2017	3	38	41	11	24	747,071
March 2017	6	23	29	11	19	8,190,142
April 2017	3	19	22	5	11	21,571,428
May 2017	4	21	25	50	15	928,571
June 2017	10	33	43	28	12	1,634,285
July 2017	6	8	14	14	11	1,785,714
August 2017	5	20	25	9	20	143,642
September 2017	7	26	33	17	17	430,285
Total	62	379	441	195	232	58,067,857

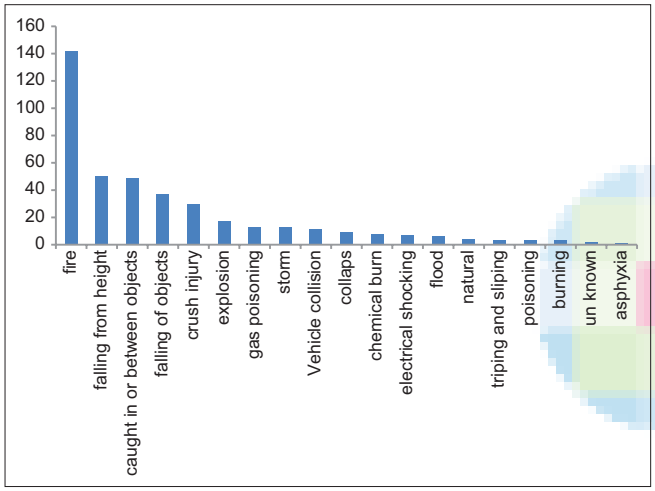

Figure 1: Frequency distribution of occupational trauma over a 1-year period in terms of types of accidents leading to trauma

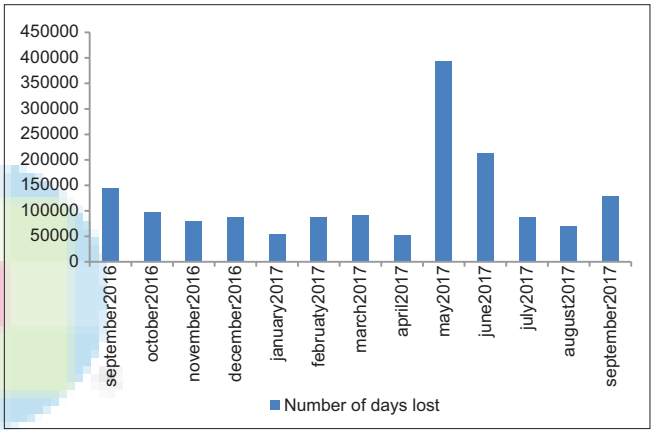

Figure 2: Frequency distribution of lost working days due to occupational trauma during a 1-year period per month

unsafe conditions was reported in January and June 2017. The percentages in the first two columns in Table 2 have been calculated proportional to 379 industrial accidents and in the second two columns proportional to 62 mining accidents. The most consequence of accidents was a process that declined over 2016 to 2017. The most traumatic provinces during the 1-year period were Mazandaran, Markazi, and Fars, and the lowest were Zanjan, Kurdistan, and Golestan, respectively.

Discussion

The present study aimed to investigate the development and extent of occupational accidents in Iran in industrial and mining sectors to determine the frequency of accidents, provide practical information for future studies, and adopt preventive methods for work-related injuries. According to the present study, the most occupational accidents occurred in industrial units followed by mining units. Mehrparvar *et al.* conducted an epidemiological survey on registered occupational accidents in Yazd, Iran, and reported the most occupational accidents in metal and construction industries.[16] In Hong Kong, a report from the Occupational Security and Health Department of medical activities suggested 41,907 cases of occupational accidents among all workers in 2010, which showed an increase of 5.9% compared to 2009. In general, in industrial sector, the incidence rates of accidents were 24.9% and 24.6% per thousand in 2010 and 2009, respectively.[17] In this study, the most common types of accidents were reported as fire, falling from height, and getting stuck, respectively. The death rate per day due to industrial accidents was 4 per thousand people in Iran (Semnan), which was less than the rates reported in Portugal (50 per thousand people) and Middle East (9 per thousand people).[18] The findings of the study showed that the highest number of accidents occurred in September 2016, and the lowest was in July 2017; the highest deaths rate was reported in May 2017 due to the explosion in one of the coal mines and the lowest was in April 2017. Results from the study by Khodabandeh and Khosravi titled epidemiological survey of work-related accidents among coal miners in Kerman province showed that the highest

Table 2: Frequency of occupational trauma based on the causes of an accident during a 1-year period

Frequency of causes of industrial accidents during a 1-year period			Frequency of causes of mining accidents during a 1-year period		Frequency of the causes of events			
Month/year	Unsafe condition	Unsafe act	Unsafe condition	Unsafe act	Human	Environmental	Process	Total
September 2016	30 (7.9)	27 (7.1)	2 (3.2)	1 (1.6)	34 (31.1)	15 (13.7)	60 (55)	109
October 2016	14 (3.6)	15 (3.9)	2 (3.2)	2 (3.2)	31 (37.8)	18 (21.9)	33 (40.2)	82
November 2016	13 (3.4)	22 (5.8)	0 (0.0)	3 (4.8)	28 (33.3)	18 (21.4)	38 (45.2)	84
December 2016	16 (4.2)	15 (3.9)	0 (0.0)	4 (6.4)	19 (26.3)	18 (25)	35 (48.6)	72
January 2017	25 (7.1)	23 (6)	3 (4.8)	2 (3.2)	21 (23.8)	24 (27.2)	43 (48.8)	88
February 2017	27 (7.1)	19 (5)	3 (4.8)	0 (0.0)	21 (25.3)	21 (25.3)	41 (49.3)	83
March 2017	18 (4.7)	10 (2.6)	6 (9.6)	1 (1.6)	18 (31)	11 (18.9)	29 (0.5)	58
April 2017	15 (3.9)	5 (1.3)	0 (0.0)	3 (4.8)	14 (31.8)	8 (18.1)	22 (0.5)	44
May 2017	19 (5)	4 (1)	2 (3.2)	3 (4.8)	16 (31.3)	10 (19.6)	25 (49)	51
June 2017	20 (5.2)	14 (3.6)	7 (11.2)	5 (8)	29 (33.7)	14 (16.2)	43 (0.5)	86
July 2017	7 (1.8)	1 (0.2)	5 (8)	1 (1.6)	12 (41.3)	3 (10.3)	14 (48.2)	29
August 2017	13 (3.4)	10 (2.6)	5 (8)	2 (3.2)	22 (39.2)	9 (16)	25 (44.6)	56
September 2017	18 (4.7)	10 (2.6)	4 (6.4)	4 (6.4)	29 (40.2)	10 (13.8)	33 (45.8)	72
Accident number	379		62		294	179	441	914

number of accidents occurred in March and the lowest number happened in the month of April.[19] The most common cause of industrial and mining accidents was unsafe conditions. The results of Ferasati et al. study evinced that unsafe act was the most common cause of the industrial accidents.[20]

The most common types of accidents were fire, falling from height, and getting stuck, respectively. The results from the study by Halvani *et al.* showed that the most common cause of the accidents was collision and fall of objects, followed by getting stuck.[21] Mehrparvar *et al.* reported getting stuck between two bodies as the most common reason for accidents, while Khodabandeh and Khosravi suggested hitting the objects and falling objects as the most important.[16,19]

In this study, the number of lost work-days was 1,514,180. In a study titled, "investigating the effectiveness of the energy saving program on occupational accidents among the workers of development and renewal organization for industries and mines of Iran in 2014," Bidhendi *et al*. found that, taking into account the death toll, the total number of lost work-days due to occupational accidents was 516,315 days during 9 years.[22]

Conclusion

Human being plays a significant role in production cycle, and the deaths associated with work-related accidents, in addition to the loss of hardware investment, may result in a loss of life, lost years of employment, and related costs. Improving employer and employees' perception of management safety practices can be important to prevent the development of job injuries and to promote workers' safety and well-being.

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Conflicts of interest

There are no conflicts of interest.

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