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Occupational Injuries Overview: General descriptive study of the Petrochemical Construction Industries

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ABSTRACT

Objectives: This paper aims at providing a general picture of the occupational injuries within the construction industry. Contributing factors have been discussed by conducting a cross section study.

Methods: Hospital registries were examined and occupational injuries data mining was done. Injuries were classified in terms of time of occurrence, age and sex of victims, the seasonal pattern of injuries, literacy condition, type of employment, type of accidents, location where accidents occurred, affected body part, causes of accident and final outcomes

Results: It was founded a fivefold increased frequency of injuries during the 3 year study period (from 12% to 57%). The main portion of cases (73.6 %) was treated without any further consequence. 1.7% of all injuries resulted in death and about 0.3% of cases terminated to permanent disabilities. Some diverse factors such as age, literacy status, seasonal variations, etc. can influence occurrence patterns of injuries. Most of the injuries occurred in the contractor's working fields.

Conclusion: Many factors can influence the construction injuries. To understand better about the construction injuries it is recommended to analyze the associated variables. Such analysis is an important input for accident prevention activities or even decision making.

Keywords: Occupational Injury, construction Industries, Injuries Contributing Factors

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Introduction

Occupational injuries impose a huge toll on the economy of all countries. According to the National Institute for Safety and Health (NIOSH), cost of occupational injuries in the U.S. is more than AIDS and as much as cancers and heart diseases[1]. The Liberty

Mutual 2005 Workplace Safety Index estimated that employers spent $50.8 billion in 2003 on the wage payments and medical care for workers hurt on the job[2]. Because of time stress in the construction projects and the harsh and changing nature of the construction tasks, these activities always have a high risk ranking among all of the industries[3]. These complicated situations make the construction sites vulnerable and can compromise the safety management systems.

Such dynamic workplaces need managing of all potential risks[4]. Despite of known significance of construction hazards, controlling the risks of such activities have been remained as a great problem. The construction industry continues to account for a large portion of work-related injuries[5]. In most countries, construction workers consist of a considerable part of the workforce, but their contribution to the injuries is higher than expected. For example, in 2004, in the United States, construction workers were 7.7% of the U.S. workforce[6] but about 22.2% of the national reported work-related deaths were recorded for these workers.

The other features of construction injuries are, among others, long time remaining away from the work and the need for more detailed documentation of injuries due to the temporary nature of the work [7]. The magnitude of the problem is well recognized in the most developed countries but in developing countries less attention has been paid to such occupational health and safety problems[8]. In developing countries, most of the tasks are done manually, exposure to risks is high and many workers injured daily. On the other hand, record keeping has a low quality and statistical databases are weak. Therefore, there is a progressive need to develop proper databases and statistical assessments for occupational injuries.

Because of the importance of the construction industry, considerable working population, the high level of risks and poor record keeping, it is vital to have more attempt to conduct and use statistical analysis and utilize related results in order to making decision in related discipline to protect working societies. Injuries data analysis and using them in the future projects can prevent recurrence of similar injuries.

Moreover, benchmarking opportunities via exploring previously analyzed patterns of injuries can facilitate equipping the sites, identifying priorities of safety and training needs.

In this study, the pattern of occupational injuries was surveyed in a large construction complex in the south of Iran. We looked for finding some facts about injuries and associated factors. The scope of our research was limited to construction sites of petrochemical area.

Materials and methods

Data collection

The present study is a cross section study of occupational injuries within construction industries. According to the regulation of many countries (including Iran), occupational accident is a situation

happening in the following cases [9]" every injury that has occurred within or outside of the workplace provided the injured person has left the workplace for the sake of his or her work or duty". Although reporting of any occupational injury is a legal requirement [10] but in our study, screening was done for all of the recorded injuries that had been referred to the central hospital of the area".

The mechanism for distinction between occupational and non-occupational injuries was based on the taking a narrative description of injury. All of injuries had a description pane to explain the cause (s) and activity during the injuries. To take a narration of injury, some questions were asked to screen the occupational injury from non-occupational cases. This questions focused around the cause of injury, time and activity of the victims while get injured. Therefore, the registry of the central hospital of the petrochemical area was scanned to find out the occupational injuries for a three year period. There were no other hospital in the area and all occupational disease was excluded from the study. It should be noted that every medical services from the outpatient to the hospitalized cases were recorded in the registry.

The study outline

The study included all recorded injuries in the hospital reception register. The gathered data were analyzed to classify occupational injuries, according to: time of occurrence, age and sex of victims, the seasonal pattern of injuries, literacy condition of injured persons, type of employment, type of accidents, location where the accident occurred, affected parts of the body, causes of accident and final outcome of injuries. Also, all groups of contractors and employer staff were included in the study. The working population present in three years was accordingly 6092, 23618 and 26092 person.

Statistical analysis

In the last phase, all of the obtained data were analyzed with SPSS software version 16. The frequency of each variable (factor) for every year was calculated. A general assessment for obtaining the data was done accordingly.

Results

The total numbers of recorded injuries for three years were 1169 cases. The numbers of occupational injuries were 140, 363 and 666 injuries respectively for three consecutive years. It was found that 99.97% of injured (1116 cases) were male and 0.3% (3 cases) were female.

Monthly occurrence pattern of injuries

Table 1 presents the frequency of injuries for various months for the whole three years.

Table 1. Monthly occurrence pattern of injuries

Month	Frequency	Percent
January	87	7.44
February	102	8.72
March	62	5.30
April	98	8.38
May	86	7.35
June	107	9.15
July	89	7.61
August	90	7.69
September	112	9.58
October	95	8.12
November	105	8.98
December	136	11.63
Total	1169	100

The Ages of injured workers

In this study, the younger workers had a more frequent injury. The workers with age of less than 30 years old suffered more than 67.8 % of all injuries, whilst the least ratio was observed in people younger than 16 and older than 60 (5.5%). The other categories showed 219 injuries (18.7 %) for ages 30- 45 and 67 cases (8%) for 45.1-60 years old.

Affected body parts

Analysis of data showed that the injuries were primarily due to harms to the Upper Extremities (36.44% of all injuries) and head injury had the second rank in the frequency of injured parts of the body (18.56%). Lower Extremity injuries, had the third rank of frequent injury (17.10%). The whole results are shown in table 2.

Table 2. Injured limb distribution

Part of body	Frequency	percent
head	217	18.56
face	92	7.86
eye	21	1.79
neck	21	1.79
trunk	76	6.50
waist	25	2.13
hand	426	36.44
foot	200	17.10
abdomen	18	1.54
other	18	1.54
missing	55	4.70
Total	1169	100

Employment status and injury location

In the total population of injured workers, 2.9% belonged to the employer staff and 85.6% belonged to the contractor work forces and 11.5% of the injured were other people on the site (like bystanders, visitors, etc. Proportional test for difference between two proportions of injuries (official employer's staffs and contractors / bystanders - visitors) revealed strongly significant differences between two groups with p-value 0.0045. Also the most common places of injuries were in the work environment (71.3%) and other places of occurrence were resting place (13.2%), route to the workplace (12.3%) and other places (2.7%) accordingly.

Causes of injuries

Although according to BLS, fall on the floor or ground surfaces are the major sources of injuries[11]. In our study striking by moving objects was the most common cause of injuries (39.4%). The second set belonged to the tear due to the sharp objects (14.54%) and falling (from a height and falls on same level) was third in the ranking (12.8%). Total types of injuries are illustrated in the table 3.

Table 3. Types of injury

Causes of injuries	Frequency	Percent
Snake and scorpion bite	7	0.6
Burns	47	4.0
Drowning	1	0.1
Electric shock	37	3.2
Fall from height/ falls on same level	150	12.8
Stroke by moving objects	461	39.4
Poisoning	19	1.6
Violence	52	4.4
Suicide	10	0.9
car accident	143	12.3
Chemical splash	5	0.4
Tearing	170	14.5
Others	48	4.1
Missing	19	1.6
Total	1169	100.0

Final outcome of Injuries

For all of injuries, 73.6 % were treated without any further consequences. 1.7% of all injuries led to death and about 0.3% terminated to the permanent disabilities. Temporary disabilities (those which were reversible or didn't restrict the future worker's capacity of work) accounted for 21% of all injuries and remaining outcomes were missing and there were no records.

Literacy of injured

We classified literacy level as: illiterate, primary literacy, diploma and college literacy. People with primary literacy and diploma had the highest frequency of injuries, 46.3% and 33.8% of all cases accordingly. Persons with college literacy accounted for 7.1% of occupational injuries and workers without literacy had a frequency of 5.8%.

Discussion and Conclusion

The first point is the increased frequency of injuries virtually 5 folds during the 3 year study period (from 12% to 57%). This increment in frequency of accident may be due to increase of the working population in the same site which can lead to the congestion, irregularity and simultaneous construction activity. On the other hand, with time progress of construction projects, stress of terminating and delivery of the project can accelerate normal activity and breaching the safety regulations. Although, there can be seen a clear seasonal variation in the community injuries rate [12]. For example, an increase in road accident associated with bad weather or agriculture increased rate of injuries related to wet seasons, but in the occupational setting there is very rare studies have done about this relationship.

Because we didn't have distribution of injuries per every month with a number of workers per every month, we couldn't find any statistics related between injury frequencies and monthly pattern of them. Some author concluded that the average age of victims of construction industries is higher than other industries[13] but some believe young age associates with the higher rate of injuries[14]. Chase and Gibeau (1979) concluded that 72.4% of all the lost time injuries are pertinent to workers under 35 year's old[17].

In the absence of control for the type of work performed and related risks, an age decreasing trend of injuries is observable [18]. The higher rate of injuries in younger worker may represent a lower level of skill and experiences in this category. Hand injuries were associated with the most lost time injuries. Although, head injuries had the second rank of frequency, but the most of their severity were negligible and didn't lead to the severe injuries**.** As a general rule, numbers of contractor's employees are considerably more than official employees.

This point implies that most injuries can occur in the contractor's scope and on the other hand, their safety management systems are more compromised than employer companies.

Many factors can influence construction safety, especially contractor's safety, amongst them, the most predominant factors are:

- Lack of management commitment and awareness of senior managers
- Lack of training
- Insufficient resource allocation
- Reckless operations[6]
- Lack of knowledge of architects and design engineers of construction safety and ignorance of Construction Hazards Prevention through Design

In general, the smaller companies have higher frequency of occupational injuries. The main problems are ignorant of the importance of safety, hiring no well-trained workers and safety personnel [15]. 11.5% of the injured were other people on the site (like bystanders, etc. A bolded hint of the finding was very high contribution of other people in the accidents of workplaces (11.5%). It points obviously the weakness of the hazard control program for interested parties in such congested working environments.

Based on the preliminary counts, the rate of fatal injury for U.S. workers, as an international reference point, in 2008 was 3.6 fatal work injuries per 100,000 full-time equivalent (FTE) workers [16]. This figure equals to 0.0036 % fatality among FTE workers. In our study the rate of fatal cases was too high (1.7%) and this figure show the fact of very weak safety management systems in contractor companies in this field [17].

In this study striking by moving objects was the most common cause of injuries (39.4%). Most of these injuries related to the traffic and transportation accidents. It could be concluded that transportation of materials and construction equipments was very common and on the other hand proper safety programs such as defensive driving or traffic safety was lacking.

Literacy level can exert its effect by the qualification and competency of workers. The little portion of college literacy persons may be due to supervisory roles of them, whilst the highest rate for lower levels of literacy may contribute to doing manual works.

The least portion of injuries for people with no literacy may be due to low involvement of this group in the population under study. In addition to the stated factors, many other factors can influence the incidence of accidents but we couldn't address them. For instance, psychological modes of workers, income, past experienced injuries, weather condition, etc. On the other hand the relation between accidents and contributing factors in some situations may be not linear and other techniques should be applied to analysis the relations. Another limitation was lack of data on the discrete monthly pattern of injuries and the exact number of workers per every month (as we described for monthly patterns). For better work we need a more complete database.

The most highlighted the key points of this study are:

a- Improvement in the safety management system as projects progress is necessary.

b- Increase of injuries with progress of project

c- The importance of managing the safety of interested parties who enter the workplaces.

d- The need for improving construction companies' occupational safety and health management systems and providing training schedules.

Mobilizing of hospitals or other medical facilities, according to the previously conducted statistical analysis of occurred injuries.

Conflict of interest statement

The authors have no conflicts of interest to declare for the current study.

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