Factors associated with the severity of fatal accidents in construction workers

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Abstract

Background: Construction work (building houses, roads, workplaces, and repairing and maintaining infrastructures) is a dangerous land-based job. This includes many hazardous tasks and conditions such as working at the following conditions: Height, excavation, noise, dust, power tools and equipment. Construction work has been increased in developed and underdeveloped countries over the past few years. Occupational fatalities have increased with an increase in this type of work. Occupational fatalities refer to individuals who pass way while on the job or performing work related tasks. In the present study, to identify the factors, personal characteristics and work-related factors associated with fatal occupational mortality were assessed using data for Tehran, Iran, 2014-2016.

Methods: We conducted a retrospective study, using 967 postmortem reports from fatal occupational injuries collected through postmortem investigations during 2014-2016. A sampling frame of 967 postmortem reports from fatal occupational injuries was used to draw a total sample of 714 fatal construction accidents for this cross-sectional study. Pearson χ² test and Kruskal-Wallis tests were used for statistical analysis.

Results: Based on the results of this study, male gender (n=714; 100%), age range of 30-39 years (n=183; 25.6%), secondary educational level (n=273; 38.2%), being married (317; 44.4%), causal employee (n=389; 54.5%), unskilled performance (389; 54.5%), no insurance coverage (472; 66.1%), and daytime duty work (287; 40.2%) were identified as risk factors for fatality in the event of construction fatal injury. A significant relationship was found between the type of injury and sociodemographic and work related variables.

Conclusion: Workers’ characteristics such as age, gender, experience, and educational background, and work related variables such as skill training, safety measurement, and close monitoring could be used to discriminate among different severity levels of occupational fatal accidents.

Keywords: Construction, Accidents, Fatality, Forensic Hall.


Introduction

Construction work is a dangerous land-based job. Some construction site jobs include building houses, roads, workplaces, and repairing and maintaining infrastructures. This work includes many hazardous tasks and conditions such as working with height, excavation, noise, dust, power tools, and equipment (1). Construction work has increased in developing and underdeveloped countries over the past few years, and with an increase in this type of work, occupational fatalities have increased. Occupational fatalities occur when individuals pass way while on the job or performing work related tasks (2). The leading safety hazards at construction sites include falls, caught between objects, electrocutions, and struck by objects (3).

All four types of mentioned hazards cause injuries and deaths at construction sites worldwide. Failure in hazard identification is often due to limited or improper training and supervision of the construction site workers (4). Falls from heights are the most common cause of in-

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2 Med J Islam Repub Iran 2016 (28 December). Vol. ... and work-related variables were analyzed. The statistical analysis included Pearson $\chi^2$ test, and Kruskal-
Wal lis tests. Significance level was set at p<0.05.

The following variables were evaluated in terms of their distribution and completeness: The outcome (fatal injury type), dependent, sociodemographic characteristics (sex, age, level of education), type of employment (full time: regular work more than 36 hours/week, part time: regular work less than 36 hours/week, causal; has no guaranteed hours of work and usually works irregular hours, fixed term, employed for a specific period of time or task, shift worker: works shifts and gets an extra payment for working shift hours), and occupation place at the time of the occupational injury, insurance state. The dependent versus the outcome variables were plotted to identify outliers and trends in the data. Categorical and ordinal variables were derived where appropriate. The categories of the cause and nature of injury variables were collapsed to group the least frequently occurring categories.

**Results**

During a two-year study, out of 967 worker fatalities in the calendar year 2014-2016, 73.8% (714) occurred in construction. The sociodemographic profile of the study participants is displayed in Table 1.

The subjects were all male adults (≥16 years), aged 18-64 years, with the mean ±SD age of 33.2±2.5 years. The most frequent occupational injuries occurred in workers aged 30-39 years (47.9% and 72.3%, respectively). Most of the deceased were married, 44.4% (317), with secondary school educational level, 30.5% (218).

With respect to nationality, some of the workers were Afghan, but the majority of the deceased workers were Iranian (91.2%). A significant relationship was found between type of injury and age group (p≤005), educational level (p≤005), marital status (p≤005), and nationality (p≤005).

Considering work-related factors in Table 2, most of the workers were unskilled (389; 54.5%) and were categorized as casual employees (54.5%). Unknown employment status accounted for 8%. Most of the accidents occurred among the simple workers due to nonstandard (unskilled) work. Most of them did not have job insurance (66.1%). In the majority (55.2%) of the cases, accidents occurred at the workplace and during day duty time (morning shift), mainly in the mornings.

| Table 1. Sociodemographic Characteristics of the Study Population |
|-----------------------------|---------|------|---------------|
| Characteristics             | Category| n    | %          |
| Age (year)                  | ≥16     | 54   | 7.6         |
|                             | 18-24   | 168  | 23.5        |
|                             | 25-29   | 112  | 15.7        |
|                             | 30-39   | 183  | 25.6        |
|                             | 40-49   | 103  | 14.4        |
|                             | ≥50     | 94   | 13.2        |
| Educational level           | Illiterate/ primary school | 29   | 4.1         |
|                             | Secondary school          | 273  | 38.2        |
|                             | High School               | 218  | 30.5        |
|                             | ≥Diploma                  | 46   | 6.4         |
| Marital state               | Single                   | 215  | 30.1        |
|                             | Married                   | 317  | 44.4        |
|                             | Widow/Separate            | 10   | 1.4         |
|                             | Unknown                   | 172  | 24.1        |
| Nationality                 | Iranian                   | 651  | 91.2        |
|                             | Afghani                   | 63   | 8.8         |
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(40.2% and 37.4%, respectively). A significant association was found between construction-related fatal accidents and employment status ($p \leq 0.05$) and performance ($p \leq 0.05$), event place ($p \leq 0.05$), event time ($p \leq 0.05$), and work eligibility ($p \leq 0.05$).

Table 3 demonstrates the details of the fatal accidents, which are as follows: Falling from the height (59.2%), stuck by thrown/projected or falling objects/heavy equipment fall over (21.1%), building/structure collapse (9.7%), expulsion/burning (3.4%), electrocution/Burn (6.6%).

With respect to the characteristics of the injury described following postmortem examination and according to frequency, they included head and neck (65.7%), upper extremities trauma including fracture (11.5%), lower extremities trauma including fracture (3.4%), trunk and back (7.1%), and multiple trauma (12.3%). The main cause of death declared by the forensic specialist was head injury in 56.9%, and multiple trauma and its complications in 43.1% of the workers.

**Discussion**

This study found statistically significant relationships between certain sociodemographic variables such as: sex, age group, educational level, marital state, nationality and work related factors such as work eli-
gibility, work time duty, and the possibility of death in the event of constructive work injury.

Being male represented a higher risk of death in the event of an occupational injury, which could be explained by their occupations having a higher level of exposure to risks than women’s occupations (12,13). This is because male employment is still clustered in certain occupations such as heavy industry and construction, where workplace dangers are the greatest (14,15).

The population under the study consisted of deceased construction workers aged older than 16 years. This shows that teenagers without required professional skills and experience are also working in construction workshops due to the lack of supervision by the related legal organizations, leading to an increase in construction occupational accidents and casualties.

Although Chau et al. found the same age distribution in their French study (16) in the European Risk Observatory Report 2006, it was reported that the accident rate for 18 to 24 year olds was higher (17). In our study, there was no trend for younger construction workers to be injured more frequently. Our population was different from those of the comparable studies. Many other studies have reported that age groups from 25 to 44 years have a higher proportion of fatal injuries, similar to our study (18,19).

The frequency of occupational injury among the married construction workers were higher than single ones, which might be attributed to mental and family problems. According to Niles (20), the main causes of human errors are complexity, stress, work environment, fatigue, education, and experiences. Stress and fatigue can be higher among the married workers than the single ones because of more responsibilities in life, leading to more unsafe actions resulting in accidents. This result conforms the findings of the researches done in Iran and in other countries (21).

According to other studies, a significant inverse relationship was obtained between unsafe behaviors and level of education. In the present study, statistical analysis revealed a higher proportion of fatal injury among the construction workers with secondary school level of education. The reason may be due to the inadequate proportion of the cases with lower educational level in this study, and considering this possibility, our results would be the same as those of other studies (22,23).

With the increasing levels of education, unsafe actions are reduced. High rates of unsafe actions among people with low literacy could be due to the following reasons: Low levels of knowledge and lack of awareness about unsafe actions and being given difficult and dangerous tasks.

In the present study, the proportion of construction injuries among unskilled and casual workers was higher, which was as consistent with the finding of other studies (24,25). Although in this study, there was a lack of information on the workers’ years of experience; it seemed that some factors such as lack of workers’ knowledge or absence of training material, especially in the safety topics, had been responsible for the higher frequency of mortality among construction workers (26-28).

With respect to the employment status of the victims of occupational injury, in this study, the association of fatal injury with causal type of employment caused higher possibility of death, as found in other researches (29,30).

This could be explained by the perception of low experience and awareness about risks associated with job, low confidence, and lack of enough working time spent for training (31). Another aspect to be noted is the high percentage of fatal injury in constructive workers while working in daytime duty. This is because active work is mostly performed in daytime.

Because of a positive skewness in the nationality distribution in this study (Iran-
nian vs. Afghani), it can be concluded that fatal accident was more common in the Iranian nationality in this study. Our statistics covered fatal accidents mainly in workplaces. Work place was the main site of majority of the fatal construction accidents in other papers (32). The number of fatal accidents taking place at the construction sites is quite alarming, and the major cause was found to be fall of persons from height and through openings (33).

The findings of the present study revealed that “falling from a height” formed the most frequent cause of fatal injury. Furthermore, the highest rate of accident consequences belonged to injuries and fractures followed by the accidents leading to death. This shows that the severity and intensity of the injuries are induced by building accidents, which is consistent with the findings of other studies (34,35). With respect to postmortem examination to determine the cause of death, head injury was the most fatal cause in this study, being mostly associated to falling from height, similar to other studies (36,37).

Conclusion
Considering the results of the current study as well as the importance of construction industries in countries such as Iran, more emphasis on preventive measures such as training the workers and using standard safety tools plus surveillance of the employers can effectively reduce the burden of such injuries. Such preventive strategies are obviously less expensive for the employers, the workers, and the society.

References

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