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# A Review of Hospitalization and Clinical Pattern of Occupational Injuries and Related Factors

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## Abstract

**Background:** Occupational injuries are considered as important factors in the loss of active human resources and useful working time; these injuries also constitute an important part of the global burden of disease. However, few studies have been performed on factors influencing the occurrence of occupational injuries. Besides, most studies have focused on the frequency of occupational injuries.
**Objectives:** The present study aimed to identify the risk factors associated with mortality, occupational injuries, and length of hospital stay and to recognize the clinical pattern in patients with occupational injuries, depending on the type and severity of injuries with the purpose of designing effective preventive interventions.
**Methods:** This cross-sectional study was conducted on 365 participants in the second half of 2015. The study sample consisted of victims suffering from occupational injuries in Shahid Rajaee Hospital, Shiraz, Iran. The data were collected, using a questionnaire through face-to-face interviews. The injury severity score (ISS), as well as demographic and clinical variables, was evaluated in the subjects. Then, the data were analyzed, using logistic, ordinal, and multinomial regression models.
**Results:** Out of 365 patients, 34 (9.3%) were female and 331 (90.7%) were male. Additionally, the mean age of the subjects was 34.26 $\pm$ 13.63 years. The results showed a significant reverse relationship between mortality and limb injury (P = 0.016) and type of fraction and dislocation (P = 0.02). Also, length of hospital stay had a significant relationship with abdominal injury (P = 0.008) and fraction and dislocation (P < 0.001). ISS within the range of 11 - 26 or $\geq$ 27 was significantly associated with mortality (P < 0.00). Moreover, age $\geq$ 56 years was directly related to severe abbreviated injury scale (AIS) (P = 0.009). In addition, limb injury had a significant reverse relationship with critical AIS (P = 0.001). Chest (P = 0.013) and limb (P = 0.006) injuries also showed a significant reverse relationship with ISS. Furthermore, abdominal injury was directly related to ISS (P = 0.023), and fracture and dislocation were directly related to AIS (P < 0.001) and ISS (P < 0.001).
**Conclusions:** By the evaluation of patients' ISS, fracture, dislocation, abdominal injury, and length of hospital stay, we can identify high-risk groups and develop necessary care and training programs in order to prevent the occurrence of injuries and decrease the length of hospital stay.

*Keywords:* Occupational Injuries, Length of Hospital Stay, Clinical Pattern, Logistic Regression

## 1. Background

Accident is defined as an unplanned process which leads to damages and casualties. Occupational injuries are considered as important factors in the loss of manpower and millions of useful working hours (1). These injuries also constitute a major part of the global burden of disease (2). The world health organization (WHO) has defined occupational accident as "an unplanned event commonly leading to personal injury, damage to machinery and working equipment, and temporary halt of production" (3). WHO has also referred to occupational injuries as an epidemic in the area of public health (4).

Occupational injuries not only cause stress for the injured person and his/her family, but also lead to capital loss and deterioration of the economic status of the country (5). In fact, manpower plays a major role in each country (6). It is a valuable asset, which is threatened by various factors, such as occupational injuries, causing negative individual and social effects (5). Despite all efforts, occupational injuries are considered as one of the most important problems both in developed and developing countries (7).

According to the latest report by the international labor office, on average, one million individuals suffered from occupational injuries in January 2010 worldwide, among whom 5500 cases lost their lives (5). According to Iran's bureau of statistics and social security, 21,740 occupational injuries occurred in the country in 2009, resulting in 110 deaths and 234 disabilities (4).

To date, few reports have explained the pattern of occupational injuries in the Middle East (8). Also, few studies have been carried out on factors influencing the occurrence of occupational injuries (9). Occupational injuries are not purely coincidental or casual events; accordingly, they can be predicted and prevented via appropriate measures (10). With this background in mind, research on occupational injuries seems to be a priority. In fact, by identifying the risk factors and processes involved in these accidents and determining the effectiveness of available preventive interventions, we can promote the awareness of mass media, policymakers, and common people regarding the adverse effects of these accidents (11).

## 2. Objectives

So far, few studies have been carried out on the risk factors for occupational injuries, and most studies in this field have focused on the frequency of such injuries (9). Therefore, the present study aimed to identify the risk factors associated with mortality, occupational injuries, and length of hospital stay and to recognize the clinical pattern in patients with occupational injuries, depending on the type and severity of injuries with the purpose of designing effective preventive interventions.

## 3. Methods

This cross-sectional study was conducted in Shahid Rajaee hospital, Shiraz, Iran in 2015. The study sample included injured individuals who were admitted to Shahid Rajaee hospital due to occupational injuries in the second half of 2015. In this study, occupational injuries were defined as injuries occurring in the workplace, including traffic-related factors, falling, stabbing, falling objects, and shots.

By using the sample size formula (mean = 2, N = 384, D = 52%, and SD = 5.2), a 384-subject sample size was determined for the study; a minimum of 365 cases remained in the study. The inclusion criteria were age of > 13 years and experience of injuries during working hours. On the other hand, the patients who were not interested in participating in the research were excluded from the study. Also, the injured, who were admitted to the hospital for operation due to factors other than occupational injuries, along with those who had a history of surgery owing to occupational injuries and were referred to the hospital for infections, were excluded from the study.

The data were collected by a trained person, using a checklist containing demographic features (e.g., age, gender, and physical condition), cause and type of injury, injury spot, and other information related to hospitalization. Content validity of the questionnaire was assessed by three professionals and was found to be acceptable (Cronbach's alpha = 0.74). All occupational injuries were determined, using a questionnaire and face-to-face interviews with victims, referred to Shahid Rajaee Hospital. Also, the victim's position during the incident at workplace was specified.

It should be noted that the method of data registration and the characteristics of victims, referring to Shahid Rajaee hospital, were important sources of information in this study. Date and time of hospital admission and discharge, as well as the length of hospital stay, were obtained, using the information available at the hospital.

In general, use of a reliable and valid system for assessing the severity of injuries in trauma patients plays a significant role in determining patient prognosis. In addition, this system can be used to evaluate the quality of medical care for the patients. For the first time in 1971, the abbreviated injury scale (AIS) was developed by the surgeon community of America to assess the severity of injuries (12). In this system, scores range from 1 to 6, considering the severity of injuries to limbs and other organs. Accordingly, scores 1, 5, and 6 represent low to moderate, severe, and fatal injuries, respectively (13).

To date, numerous tables have been applied to calculate AIS scores for different organs. Since AIS was only used to determine the severity of injuries to organs and not multiple injuries, Baker and colleagues developed the injury severity score (ISS) for multi-trauma patients in 1974 (13, 14). In this system, to assess the severity of injuries, body is divided into six parts, including the head, neck, face, abdomen, limbs, and buttocks.

In the current study, to assess the severity of injuries, body was divided into head and neck, chest, face, and abdomen. To calculate the ISS, first, the injured organs and limbs were characterized in AIS, and then, three injuries with the highest AIS scores were selected and square-rooted to two. Afterwards, the sum of these three injuries was considered as the ISS ($ISS = X^2 + Y^2 + Z^2$). The minimum and maximum ISSs were $1^2 + 1^2 + 1^2 = 3$ and $5^2 + 5^2 + 5^2 = 75$, respectively. It should be noted that if the AIS score was 6, ISS was automatically determined as 75 (15). In this study, ISS was classified into three groups, i.e., 1 - 10, 11 - 26, and > 27, and was computed by a physician.

Univariate analysis was performed, using Chi-square test, while multivariate analysis was carried out through multinomial, ordinal, and logistic regression models. Odds ratio (OR), P value, and 95% confidence interval (CI) were reported for logistic and ordinal regression models. Besides, relative risk ratio (RR), P value, and 95% CI were calculated for the multinomial regression model. All the analyses were performed, using Stata software version 12 and P value less than 0.05 was considered statistically significant. "O model" and "S post" were downloaded to test the proportional odds hypothesis, which was checked through "Findit S post" and "Findit O model" commands. In all the cases, this hypothesis was established for ISS, but not for AIS; therefore, the multinomial regression model was used for the analysis.

## 4. Results

Among 365 patients in the present study, 34 (9.3%) were female and 331 (90.7%) were male. The mean age of the subjects was $34.26 \pm 13.63$ years. Descriptive analysis of mortality and length of hospital stay in the patients is presented in Table 1. The results of this study showed that age of $\geq$ 56 years was directly related to mortality (P = 0.008, OR = 26.4, and 95% CI: 2.3 - 298.2). Limb injury also showed a significant reverse relationship with mortality (P = 0.016, OR = 0.01, and 95% CI: 0.1 - 0.42). Besides, abdominal injury was directly related to the length of hospital stay (P = 0.008, OR = 4.4, and 95% CI: 1.4 - 13.7).

Moreover, ISS range of 11 - 26 was directly associated with mortality (P = 0.003, OR = 24.3, and 95% CI: 2.9 - 204.3). ISS $\geq$ 27 also showed a direct relationship with mortality (P < 0.001, OR = 293.7, 95% CI: 23.6 - 3643.3). Moreover, fracture and dislocation had a significant reverse relationship with mortality (P = 0.002, OR = 0.04, and 95% CI: 0.01 - 0.31). Fracture and dislocation also demonstrated a direct relationship with the length of hospital stay (P < 0.001, OR = 4.7, and 95% CI: 0.2.4 - 9.1). Multivariate analysis of mortality and length of hospital stay is summarized in Table 2. Additionally, descriptive results of ISS analysis are presented in Table 3.

The study findings showed a reverse relationship between ISS and chest (P = 0.006, OR = 0.38, and 95% CI: 0.19 - 0.76) and limb (P = 0.13, OR = 0.13, and 95% CI: 0.2 - 0.56) injuries. Additionally, a direct relationship was observed between abdominal injury and ISS (P = 0.023, OR = 3.5, and 95% CI: 1.1 - 10.7). Fracture and dislocation also showed a direct relationship with ISS (P < 0.001, OR = 4.8, and 95% CI: 2.1 - 10.6). The results of multivariate analysis of ISS are presented in Table 4. The AIS descriptive results are also shown in Table 5.

The study results showed a direct relationship between age of $\geq$ 56 years and severe AIS (P = 0.009, RR = 6.5, and 95% CI: 1.5 - 26.9). Besides, a significant reverse relationship was found between limb injuries and critical AIS (P = 0.001, RR = 0.13, and 95% CI: 0.04 - 0.46). On the other hand, abdominal injury had a direct relationship with critical AIS (P = 0.14, RR = 10.4, and 95% CI: 1.6 - 68.0). Moreover, pain showed a significant reverse relationship with moderate AIS (P = 0.43, RR = 0.47, and 95% CI: 0.22 - 0.97). Furthermore, fracture and dislocation were directly associated with all sub-groups of AIS (all P < 0.001). Considering the cause of injury, falling showed a significant reverse relationship with serious AIS (P = 0.046, RR = 0.37, and 95% CI: 0.14 - 0.98). The results of AIS multivariate analysis are shown in Table 6.

## 5. Discussion

The present study aimed to develop a clinical model for occupational injuries, depending on the type and severity of injuries and to identify the factors associated with hospitalization for injuries, caused by work accidents in patients, referred to Shahid Rajaee hospital, Shiraz, Iran (as the main trauma center in Shiraz). The purpose was to discover key strategies for preventing and reducing injuries and accidents at workplace.

The study results indicated that the frequency of occupational injuries was 90% among males. It should be noted that male-to-female ratio was 9: 7 in this study. Also, in a study in Kermanshah, Iran, 89.8% of injuries occurred among men (16). This can be attributed to the socioeconomic condition of our society where women are mostly homemakers. Similarly, in all studies conducted at trauma centers in other countries, the outbreak of trauma was higher among males. Nonetheless, Davis and colleagues (17) stated that this rate was equal among male and female participants.

Moreover, the present results demonstrated that most occupational injuries occurred among young males, which is in line with the results of studies conducted in most emergency centers around the world (18). A large number of occupational injuries among the youth, particularly in developing countries, results from poor safety and road accidents (19). This might be due to the fact that the youth are less experienced and have not received adequate training (2). In the present study, the mean age of subjects with occupational injuries was 34 + 14 years. Additionally, the frequency of occupational injuries was 65.2% among subjects below 35 years of age, who seem to have the highest efficiency in society. This finding is in agreement with the results of a study by Ahmadi Amoli et al. (20).

In the current study, traffic accidents and falls were the most common causes of occupational injuries. This

**Table 1.** Description of the Socio-Demographic Factors of Occupational Injuries in Shiraz, Fars Province, Iran[a]

| | Total (n = 365) | Not Survived (n = 14) (3.8%) | Survived (n = 351) (96.2%) |
|---|---|---|---|
| **Gender** | | | |
| Female | 34 (9.3) | 0 | 34 (100.0) |
| Male | 331 (90.7) | 14 (4.2) | 317 (95.8) |
| **Age, y** | | | |
| ≤35 | 238(65.2) | 7 (2.9) | 231 (97.1) |
| 36 - 55 | 87 (23.8) | 3 (3.4) | 84 (96.6) |
| ≥ 56 | 40 (11.0) | 4 (10.0) | 36 (90.0) |
| **Marital status** | | | |
| Single | 163 (44.7) | 7 (8.3) | 159 (97.6) |
| Married | 202 (55.3) | 10 (4.9) | 192 (95.1) |
| **Injured body region** | | | |
| Head and neck | 84(23.0) | 7 (8.4) | 77 (91.6) |
| Face | 21(5.8) | 1 (4.8) | 20 (95.2) |
| Chest | 30(8.2) | 1 (3.3) | 29 (96.7) |
| Abdomen | 19 (5.2) | 4 (21.0) | 15 (79.0) |
| Extremities | 211 (57.8) | 1 (.4) | 210 (99.6) |
| **Injury severity score (ISS)** | | | |
| 1 - 10 | 285 (78.1) | 3 (1.1) | 282 (98.9) |
| 11 - 26 | 62 (17.0) | 4 (6.5) | 58 (93.5) |
| ≥ 27 | 18 (4.9) | 7 (38.9) | 11 (61.1) |
| **Occupation** | | | |
| Worker | 250 (68.5) | 6 (2.4) | 244 (97.6) |
| Professional | 61 (16.7) | 3 (4.9) | 58(95.1) |
| Others | 54 (14.8) | 5 (9.3) | 49 (90.7) |
| **Level of education** | | | |
| Illiterate | 46 (12.6) | 2 (4.4) | 44 (95.6) |
| Below diploma | 129 (35.3) | 1 (.8) | 128 (99.2) |
| Diploma | 151 (41.4) | 9 (6.0) | 142 (94.0) |
| Above diploma | 39 (10.7) | 2 (5.1) | 37 (94.9) |
| **Type of injury** | | | |
| Non-pertaining injury | 74 (20.3) | 8 (10.8) | 66 (89.2) |
| Pain | 112 (30.7) | 2 (1.8) | 110 (98.2) |
| Fracture and dislocation | 179 (49.0) | 4 (2.2) | 175 (97.8) |
| **Length of hospital stay (days)** | | | |
| ≤2 | 224 (61.4) | 9 (4.0) | 215 (96.0) |
| > 2 | 141 (38.6) | 5 (3.5) | 136 (96.5) |

[a]Values are expressed as No. (%).

finding was in consistence with the results of studies conducted by Mehrparvar et al. in Colombia (21) and Yusefzadeh (16). Overall, these figures represent a serious threat to the active and young population. According to statistics, more than 50 million people are injured and 1.2 million are annually killed by traffic accidents worldwide, 90% of whom reside in low- and middle-income countries (16).

In this study, a scoring system was used to assess the severity of injuries. Most of the victims' ISSs ranged between 1 and 10, which is justifiable considering the prevalence of mild injuries. These results are consistent with those reported by Ahmadi Amoli and colleagues (20). However, the current results showed a mortality rate of 3.8%, which is not consistent with that reported by Ahmadi et al. in Turkey. The low mortality rate in this study compared to the international figures can be due to deaths occurring at the accident site, which was not recorded in this study.

In contrast to the study performed by Ahmadi Amoli et al., fracture and dislocation (49%) comprised the most common types of injuries in the present research; therefore, educational programs and care services are necessary. In addition, the current study findings indicated no sig-

**Table 2.** Description of the Socio-Demographic Factors of Occupational Injuries in Shiraz, Fars Province, Iran[a]

| | Total (n = 365) | ≤ 2 (days) (n = 224) (61.4%) | > 2 (days) (n = 141) (38.6%) |
|---|---|---|---|
| **Gender** | | | |
| Female | 34 (9.3) | 19 (55.9) | 15 (44.1) |
| Male | 331 (90.7) | 205 (61.9) | 126 (38.1) |
| **Age, y** | | | |
| ≤ 35 | 238 (65.2) | 156 (65.5) | 82 (34.5) |
| 36 - 55 | 87 (23.8) | 47 (54.1) | 40 (45.9) |
| ≥ 56 | 40 (11.0) | 21(52.5) | 19 (47.5) |
| **Marital status** | | | |
| Single | 163 (44.7) | 110 (67.5) | 53 (32.5) |
| Married | 202 (55.3) | 114 (56.4) | 88 (43.6) |
| **Injured body region** | | | |
| Head and neck | 84 (23.0) | 59 (70.2) | 25 (29.8) |
| Face | 21 (5.8) | 9 (42.9) | 12 (57.1) |
| Chest | 30 (8.2) | 20 (66.7) | 10 (33.3) |
| Abdomen | 19 (5.2) | 7 (36.8) | 12 (63.2) |
| Extremities | 211 (57.8) | 129 (61.1) | 82 (38.9) |
| **Injury severity score (ISS)** | | | |
| 1 - 10 | 285 (78.1) | 183 (64.2) | 102 (35.8) |
| 11 - 26 | 62 (17.0) | 33 (53.2) | 29 (46.8) |
| ≥ 27 | 18 (4.9) | 8 (44.4) | 10 (55.6) |
| **Occupation** | | | |
| Worker | 250 (68.5) | 152 (60.8) | 98 (39.2) |
| Professional | 61 (16.7) | 41 (67.2) | 20 (32.8) |
| Others | 54 (14.8) | 31 (57.4) | 23 (42.6) |
| **Level of education** | | | |
| Illiterate | 46 (12.6) | 27 (58.7) | 19 (41.3) |
| Below diploma | 129 (35.3) | 85 (65.9) | 44 (34.1) |
| Diploma | 151 (41.4) | 82 (54.3) | 69 (45.7) |
| Above diploma | 39 (10.7) | 30 (76.9) | 9 (23.1) |
| **Type of injury** | | | |
| Non-pertaining injury | 74 (20.3) | 56 (75.7) | 18 (24.3) |
| Pain | 112 (30.7) | 91 (81.3) | 21 (18.7) |
| Fracture and dislocation | 179 (49.0) | 77 (43.1) | 102 (56.9) |

[a]Values are expressed as No. (%).

**Table 3.** The Time Interval Between the Accident and Hospital Admission

| Time, Min | Frequency (%) |
|---|---|
| **30 >** | 168 (46.1) |
| **60 - 31** | 160 (43.8) |
| **61 <** | 37 (10.1) |
| **Total** | 365 (100) |

nificant relationship between ISS and different age groups, which might be attributed to the fact that the majority of occupational injury victims were ≤ 35 years of age.

In this study, hospitalization for less than two days had the highest frequency; this can be justified by the high percentage of mild injuries. Overall, the vehicle used for transferring injured patients to the hospital is an important issue in developing countries. According to the study conducted by Taghavi et al. in a dozen provinces, 7.2%, 90.8%, and 5% of the injured individuals in Tehran, Iran

**Table 4.** The Vehicle Used for Hospital Transfer

| Transfer Vehicle | Frequency (%) |
|---|---|
| **Ambulance 115** | 303 (83) |
| **Private vehicle** | 46 (12.6) |
| **Others** | 16 (4.4) |
| **Total** | 365 (100) |

**Table 5.** Cause of Injury

| Cause of Injury | Frequency (%) |
|---|---|
| **Traffic accident** | 201 (55) |
| **Falling down** | 105 (28.8) |
| **Falling objects** | 24 (6.6) |
| **Others** | 35 (9.6) |
| **Total** | 365 (100) |

**Table 6.** Adjusted Odds Ratio (OR) of Factors Associated With Mortality and Length of Hospital Stay[a]

| | Mortality | | Length of Hospital Stay | |
|---|---|---|---|---|
| | **OR (95% CI)** | **P Value** | **OR (95% CI)** | **P Value** |
| **Age, y** | | | | |
| $\leq$ 35 | Reference | Reference | Reference | Reference |
| 35 - 55 | 4.5 (64 - 32.45) | 0.127 | - | - |
| $\geq$ 56 | 26.4 (2.3 - 298.2) | 0.008 | - | - |
| **Injured body region** | | | | |
| Head and neck | Reference | Reference | Reference | Reference |
| Face | 1.2 (0.06 - 22.2) | 0.901 | 2.4 (0.84 - 7.3) | 0.098 |
| Chest | 1.9 (0.16 - 22.7) | 0.602 | 1.1 (0.41 - 2.8) | 0.912 |
| Abdomen | 0.3 5 (0.04 - 3.1) | 0.343 | 4.4 (1.4 - 13.7) | 0.008 |
| Extremities | 0.01 (0.01-.42) | 0.016 | 1.1 (0.55 - 1.8) | 0.949 |
| **Injury severity score (ISS)** | | | | |
| 1 - 10 | Reference | Reference | Reference | Reference |
| 11 - 26 | 24.3 (2.9 - 204.3) | 0.003 | - | - |
| $\geq$ 27 | 293.7 (23.6 - 3643.3) | < 0.001 | - | - |
| **Type of injury** | | | | |
| Non-pertaining injury | Reference | Reference | Reference | Reference |
| Pain | 0.21 (0.02 - 1.7) | 0.152 | 0.78 (0.3 7 - 1.6) | 0.517 |
| Fracture and dislocation | 0.04 (0.01 - 0.31) | 0.002 | 4.7 (2.4 - 9.1) | < 0.001 |

[a] SD, standard deviation; CI, confidence interval.

were transferred to the nearest treatment centers by ambulances, cars, and emergency ambulances, respectively (16). In the present study, ambulance was the most common vehicle with a frequency of 83%; this finding is not consistent with the results obtained by Yusefzadeh and colleagues. These figures reflect the favorable situation of patient transfer and use of appropriate quantitative and qualitative medical care services and facilities.

Evidence has shown that the highest rate of occupational injuries occurs in the morning, while the lowest rate is reported during the evening shifts (21). Similarly, in our study, 62.5%, 22.5%, and 15% of the injuries occurred in the morning, evening, and night shifts, respectively. Additionally, the most common time of injury was the beginning and middle of work shift, which is in agreement with the findings of a study by Farhadi. Similarly, a study in Turkey revealed that the prevalence of injuries was higher in the early hours of work. This implies that night work or possible fatigue caused by sleep had less impact on occupational injuries (22); these results are consistent with those

**Table 7.** Descriptive Analysis of Injury Severity Scores (ISSs)[a]

| | Total (n = 365) | ISS | | |
|---|---|---|---|---|
| | | 1 - 10, n = 285 (78.1%) | 11 - 26, n = 62 (17.0%) | ≥ 27, n = 18 (4.9%) |
| **Gender** | | | | |
| Female | 34 (9.3) | 29 (85.3) | 4 (11.8) | 1 (2.9) |
| Male | 331 (90.7) | 256 (77.3) | 58 (17.5) | 17 (5.2) |
| **Age, y** | | | | |
| ≤ 35 | 238 (65.2) | 192 (80.7) | 34 (14.3) | 12 (5.0) |
| 36 - 55 | 87 (23.8) | 65 (74.7) | 19 (21.8) | 3 (3.5) |
| ≥ 56 | 40 (11.0) | 28 (70.0) | 9 (22.5) | 3 (7.5) |
| **Injured body region** | | | | |
| Head and neck | 84 (23.0) | 62 (73.8) | 16 (19.0) | 6 (7.2) |
| Face | 21 (5.8) | 17 (81.0) | 3 (14.3) | 1 (4.76) |
| Chest | 30 (8.2) | 28 (93.3) | 2 (6.7) | 0 |
| Abdomen | 19 (5.2) | 10 (52.6) | 3 (15.8) | 6 (31.6) |
| Extremities | 211 (57.8) | 168 (79.6) | 38 (18.0) | 5 (2.4) |
| **Type of injury** | | | | |
| Non-pertaining injury | 74 (20.3) | 63 (85.1) | 6 (8.1) | 5 (6.8) |
| Pain | 112 (30.7) | 107 (95.5) | 3 (2.7) | 2 (1.8) |
| Fracture and dislocation | 179 (49.0) | 115 (64.2) | 53 (29.6) | 11 (6.2) |
| **Cause of injury** | | | | |
| Traffic accident | 201 (55.0) | 154 (76.6) | 34 (16.9) | 13 (6.5) |
| Fall | 105 (28.8) | 81 (77.1) | 23 (21.9) | 1 (1.0) |
| Falling objects | 24 (6.6) | 18 (75.0) | 3 (12.5) | 3 (12.5) |
| Others | 35 (9.6) | 32 (91.4) | 2 (5.7) | 1 (2.9) |

[a]Values are expressed as No. (%).

**Table 8.** Adjusted Odds Ratio (OR) of Factors Associated With the Injury Severity Score (ISS) Classification in Occupational Injuries[a]

| | ISS Classification | |
|---|---|---|
| | OR (95% CI) | P Value |
| **Injured body region** | | |
| Head and neck | Reference | Reference |
| Face | 0.38 (0.1 - 1.3) | 0.143 |
| Chest | 0.13 (0.02 - 0.65) | 0.013 |
| Abdomen | 3.5 (1.1 - 10.7) | 0.023 |
| Extremities | 0.38 (0.19 - 0.76) | 0.006 |
| **Type of injury** | | |
| Non-pertaining injury | Reference | Reference |
| Pain | 0.32 (0.10 - 1.1) | 0.053 |
| Fracture and dislocation | 4.8 (2.1 - 10.6) | < 0.001 |

[a]SD, standard deviation; CI, confidence interval.

reported by Mehrparvar et al. (21).

The present results indicated a significant relationship between age > 56 years and mortality, which is in consistence with the results obtained by Ahmadi and colleagues. It should be noted that as age advances, other factors associated with mortality, such as chronic diseases, increase, as well. The results also revealed a significant reverse relationship between mortality and limb injuries, fracture, and dislocation, which could be justified by the mild ISS. In addition, most injuries were related to head and neck, which is consistent with the findings of a study by Davoodabadi et al. (17).

The present results also demonstrated that the length of hospital stay had a significant relationship with abdom-

**Table 9.** Descriptive Results of the Abbreviated Injury Scale (AIS)[a]

| | Total (n = 365) | AIS | | | | |
|---|---|---|---|---|---|---|
| | | Minor, n = 126 (34.5%) | Moderate, n = 93 (25.5%) | Serious, n = 77 (21.1%) | Severe, n = 38 (10.4%) | Critical, n = 31 (8.5%) |
| **Gender** | | | | | | |
| Female | 34 (9.3) | 16 (47.1) | 5 (14.7) | 8 (23.5) | 3 (8.8) | 2 (5.9) |
| Male | 331 (90.7) | 110 (33.2) | 88 (26.6) | 69 (20.8) | 35 (10.6) | 29 (8.8) |
| **Age, y** | | | | | | |
| ≤ 35 | 238 (65.2) | 87 (36.6) | 66 (27.7) | 46 (19.3) | 18 (7.6) | 21 (8.8) |
| 36 - 55 | 87 (23.8) | 28 (32.2) | 18 (20.7) | 22 (25.3) | 11 (12.6) | 8 (9.2) |
| ≥ 56 | 40 (11.0) | 11 (27.5) | 9 (22.5) | 9 (22.5) | 9 (22.5) | 2 (5.0) |
| **Injured body region** | | | | | | |
| Head and neck | 84 (23.0) | 33 (39.3) | 22 (26.2) | 9 (10.7) | 8 (9.5) | 12 (14.3) |
| Face | 21 (5.8) | 7 (33.3) | 8 (38.1) | 4 (19.0) | 1 (4.8) | 1 (4.8) |
| Chest | 30 (8.2) | 12 (40.0) | 7 (23.3) | 8 (26.7) | 1 (3.3) | 2 (6.7) |
| Abdomen | 19 (5.2) | 3 (15.8) | 6 (31.6) | 2 (10.5) | 1 (5.3) | 7 (36.8) |
| Extremities | 211 (57.8) | 71 (33.6) | 50 (23.7) | 54 (25.6) | 27 (12.8) | 9 (4.3) |
| **Type of injury** | | | | | | |
| Non-pertaining injury | 74 (20.3) | 37 (50.0) | 24 (32.4) | 3 (4.1) | 2 (2.7) | 8 (10.8) |
| Pain | 112 (30.7) | 82 (73.2) | 24 (21.4) | 2 (1.8) | 2 (1.8) | 2 (1.8) |
| Fracture and dislocation | 179 (49.0) | 7 (3.9) | 45 (25.2) | 72 (40.2) | 34 (19.0) | 21 (11.7) |
| **Cause of injury** | | | | | | |
| Traffic accident | 201 (55.0) | 66 (32.8) | 52 (25.9) | 46 (22.9) | 19 (9.4) | 18 (9.0) |
| Fall | 105 (28.8) | 34 (32.4) | 25 (23.8) | 22 (21.0) | 16 (15.2) | 8 (7.6) |
| Falling objects | 24 (6.6) | 8 (33.3) | 2 (8.4) | 8 (33.3) | 1 (4.2) | 5 (20.8) |
| Others | 35 (9.6) | 18 (51.4) | 14 (40.0) | 1 (2.9) | 2 (5.7) | 0 |

[a]Values are expressed as No. (%).

inal injury and fracture/dislocation, which could result from the high ISSs in both injury areas. Other factors, such as age, are also involved in the length of treatment and hospital stay, which should be kept in mind.

In the present study, ISSs of 11 - 26 and ≥ 27 were associated with mortality, confirming the Baltimore's congress report (14). This implies that a rise in ISS is directly associated with the increased risk of mortality. Nevertheless, it should be noted that the risk of mortality is also related to other factors, including the patient's age and presence of chronic diseases. Only 14 deaths occurred in the current study, which is not statistically sufficient for a close examination of the relationship among ISS, age, and mortality; therefore, this relationship has to be evaluated in larger sample sizes.

A previous study assessed the relationship between length of hospital stay and ISS. According to the results, 90% of the victims whose ISS ranged from 25 to 54 were hospitalized for more than 10 days, while only 19% of the victims with ISS of 1 - 24 were hospitalized for more than 10 days (23). Consequently, the more severe the injuries and the higher the scores are, the longer the hospital stay would be. The returning time of victims to work can be also estimated, based on ISS; however, this factor was not evaluated in this study due to the lack of follow-up.

The findings of this study indicated a direct relationship between age ≥ 56 years and severe AIS. Besides, limb injury showed a significant reverse relationship with critical AIS. On the other hand, abdominal injury was directly related to critical AIS. Pain had a significant reverse relationship with moderate AIS, and falling was significantly associated with serious AIS. Furthermore, chest and limb injuries had a significant relationship with ISS. Abdominal injury and fracture/dislocation also showed a direct relationship with ISS.

As mentioned before, there is a scarcity of research on factors influencing the occurrence of occupational injuries (17). Additionally, most studies conducted in this field have only focused on the frequency of occupational injuries. The present study was the first research examining occupational injuries, resulting in hospitalization; consequently, in some cases, no similar studies could be found for the comparison of the results.

As mentioned before, the present study is the first research examining occupational injuries resulting in hospitalization; this is in fact a major point of strength in this study. In addition, the clinical data were collected by our expert team through face-to-face interviews. On the other hand, the limitation of this study was the incomplete information in the hospital information system.

Iran is a country with a quite young population. The findings of this study indicated that most occupational injuries occurred among young men due to traffic accidents and falls. Additionally, fracture/dislocation and abdominal injury were directly related to the length of hospital stay. Besides, rise in ISS was accompanied with an increase in the length of hospital stay. Overall, considering the current study results, occupational injuries in high-risk groups can be identified, using a clinical pattern. In fact, by developing an educational program, effective steps can be taken towards preventing such injuries and decreasing the length of hospital stay.

Future studies are suggested to assess the outcomes and length of hospital stay among the victims of occupational injuries, based on ISS. Considering the high prevalence of injuries in limbs, head, and neck, this scale can also help surgeons make the right therapeutic decision. Moreover, as 70% of deaths caused by injuries in developing countries occur in the pre-hospital phase (24), serious cases should be evaluated and recorded in future studies. The high rate of occupational injuries due to traffic accidents and falls among young men is also among the important points, which should be addressed as a priority in health care.

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## Footnotes

**Authors' Contribution:** Study concept and design: Mojtaba Norouzi; acquisition of data: Mojtaba Norouzi; analysis and interpretation of data: Mojtaba Norouzi; drafting of the manuscript: Mojtaba Norouzi; critical revision of the manuscript for important intellectual content: Mojtaba Norouzi; statistical analysis: Mojtaba Norouzi; administrative, technical, and material support: Haleh Ghaem; and study supervision: Haleh Ghaem.

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**Table 10.** Adjusted Relative Risk Ratio (RR) of Factors Associated With the Abbreviated Injury Scale (AIS) in Occupational Injuries[a]

| | AIS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Minor, RR (95% CI)** | **Moderate, RR (95% CI)** | **P Value** | **Serious, RR (95% CI)** | **P Value** | **Severe, RR (95% CI)** | **P Value** | **Critical, RR (95% CI)** | **P Value** |
| **Age, y** | | | | | | | | | |
| ≤ 35 | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| 36 - 55 | Reference | 0.43 (0.18 - 1.0) | 0.054 | 0.54 (0.19 - 1.4) | 0.233 | 70 (0.22 - 2.1) | 0.544 | 0.48 (0.14 - 1.6) | 0.246 |
| ≥ 56 | Reference | 1.3 (0.44 - 3.8) | 0.621 | 2.5 (0.63 - 9.9) | 0.187 | 6.5 (1.5 - 26.9) | 0.009 | 0.48 (0.06 - 3.5) | 0.480 |
| **Injured body region** | | | | | | | | | |
| Head and neck | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Face | Reference | 0.93 (0.21 - 4.0) | 0.933 | 0.49 (0.06 - 3.6) | 0.491 | 0.13 (0.01 - 1.8) | 0.153 | 0.12 (0.01 - 1.7) | 0.121 |
| Chest | Reference | 0.8 (0.26 - 2.9) | 0.836 | 1.9 (0.37 - 10.3) | 0.418 | 0.27 (0.02 - 3.1) | 0.301 | 0.39 (0.05 - 2.7) | 0.344 |
| Abdomen | Reference | 3 (0.58 - 16.7) | 0.180 | 2.2 (0.20 - 25.1) | 0.501 | 0.67 (0.04 - 11.3) | 0.788 | 10.4 (1.6 - 68.0) | 0.014 |
| Extremities | Reference | 0.62 (0.28 - 1.3) | 0.228 | 0.78 (0.24 - 2.4) | 0.669 | 0.34 (0.10 - 1.1) | 0.081 | 0.13 (0.04 - 0.46) | 0.001 |
| **Type of injury** | | | | | | | | | |
| Non-pertaining injury | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Pain | Reference | 0.47 (0.22 - 0.97) | 0.043 | 0.36 (0.05 - 2.3) | 0.290 | 0.50 (0.06 - 3.9) | 0.518 | 0.19 (0.03 - 1.1) | 0.058 |
| Fracture and dislocation | Reference | 17.8 (6.0 - 52.3) | < 0.001 | 238.5 (50.5 - 1125) | < 0.001 | 205.4 (33 - 1271) | < 0.001 | 55.1 (12.9 - 234.8) | < 0.001 |
| **Cause of injury** | | | | | | | | | |
| Traffic accident | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference | Reference |
| Fall | Reference | 0.60 (0.27 - 1.3) | 0.215 | 0.37 (0.14 - 0.98) | 0.046 | 0.63 (0.21 - 1.8) | 0.398 | 0.44 (0.13 - 1.4) | 0.177 |
| Falling objects | Reference | 0.25 (0.04 - 1.4) | 0.127 | 1.1 (0.21 - 6.17) | 0.871 | 0.33 (0.02 - 3.8) | 0.380 | 1.2 (0.23 - 6.6) | 0.786 |
| Others | Reference | 1.7 (0.71 - 4.4) | 0.216 | 0.33 (0.03 - 3.3) | 0.353 | 1.7 (0.27 - 10.5) | 0.565 | 1.1 (0.12 - 1.1) | 0.980 |

[a] SD, standard deviation; CI, confidence interval.