Evaluation of Injuries among a Manufacturing Industry Staff in Iran

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Abstract

Background: Occupational injury is related to personal characteristics. This phenomenon is a controversial issue. This paper presents the relationships of certain occupational and individual characteristics with frequency of occupational injuries.

Methods: A standardized injury questionnaire was completed for 199 employees in a big Iranian industrial company (MAPNA Group) by the researcher in the presence of the subjects. The data were analyzed using zero-inflated Poisson regression with random effects.

Results: We demonstrated a significant relation between the marital status ($P < 0.001$) and score of injuries ($P < 0.001$) with number of injuries by employees. Technicians and supervisors have high chance of "not to be injured at all" relative to workers ($P < 0.05$). Technicians and supervisors have less number of injuring than workers have ($P < 0.05$). In addition, increasing assessment score decreases the number of injuring of employees ($P < 0.001$).

Conclusion: Due to being aware of the risks and remedial measures, married employees and workers should be assisted by occupational specialists.

Keywords: Occupational injury, Industry, Iran

Introduction

Injuries and non-communicable diseases are significant contributors to childhood, adolescent and adulthood deaths and morbidity in developing countries (1, 2). Despite their high prevalence, injuries remain a neglected public health problem in developing countries (3, 4). It is important to identify risk factors in order to inform, plan, implement and evaluate health promotion policies and strategies that reduce the occurrence of injuries (5, 6). Risk factors associated with injuries include socioeconomic, demographic, psychosocial and behavioral factors (7). Occupational injuries result in severe socioeconomical consequences (8, 9). The annual incidence of injuries workers from the Iranian Ministry of Labor (IML) is 43%. Occupational injuries are mainly caused by work conditions (10), but some individual characteristics also increase the risk of accidents (11, 12). Some workers have more than one injury during a short period. Therefore, identification of risk factors involving in injury management should be taken into consideration (13, 14). The concept of injury is used to indicate that many individuals have more accident-related health problems than others (15, 16). Green (15) was the first to observe that a relatively small proportion of workers in a British munitions factory had most of the injuries. He suggested that the explanation for this clustering of injuries in certain persons was to be found in their personality make up.
Several researches were conducted in different areas of Iran. All of these tried to expect prevalence of work accident or to find relation between accident and many factors (17-22). The objective of this research was to investigate the individual and occupational factors in the frequency of occupational injuries in a manufacturing industry in Iran. In terms of basic personal characteristics, we regard number of injury as the tendency of an individual to experience more injury than others. We did not include exposure to risk as part of the definition itself, because the extent to which individuals expose themselves to risk may be largely determined by personality characteristics.

**Material and Methods**

This study was carried out in a manufacturing industry (MAPNA Group) with eight branches that are spread out in the many provinces of Iran. Then we selected proportional to size of each branch's employers who worked in duration of 2007 in this manufacturing industry. An injury proneness questionnaire was used to evaluate the injury proneness (23). The questionnaire has 65 questions that questions have five-scale responding alternative, “never=0”, “rarely=1”, “sometimes=2”, “often=3”, “most times=4”. The score of each employer's injuring is summation of 65 questions scores. Then Persian version of this questionnaire was provided. After questionnaire validity checking, it had high reliability (Cronbach’s alpha: 0.726). Furthermore, the number of occupational injury in the 2007, work experience (years), job (0: Workers, 1: Technician, 2: Supervisors 3: Managers), marital status (0: Single 1: Married) and workplace (company) were included.

**Statistical analysis**

The number of injured for employees is count data and Poisson regression is appropriate model for analyzing such data. In many situations where there is over-dispersion or excess zero, other distribution such as zero-inflated Poisson (ZIP) or negative binomial (NB) may be more appropriate for fitting data. The ZIP distribution regards as mixture of Poisson distribution and degenerate component placing all its mass at zeros. For counts, ZIP regression model is to examine the effects of risk factors or confounders by allowing both log-linear and the logistic regression to be linear functions of some covariates. In this context, there are score tests for extra zeros where the zero-inflation probability depends on covariates (24), and correlated count data (25). Xiang et al. (26) presented a score test for over-dispersion in a zip mixed regression. We used these score tests for model selection.

In this cross-sectional study, because employees were nested within company, zero-inflated mixed Poisson regression (27) applied for analysis the data. We did analysis of data with programs that are written with S-plus and Wald score test to justify about parameters significant level.

**Results**

The mean SD of age of the people under study was 30.4 (6.4) yr. The work experiences mean was 7.0 (4.99) yr. About 48% were high school educated and 34% were college-educated. About 73% of samples were married and 24% had experienced an injury or more at their work. The mean score in assessment of injury was 60.3 (10.18). The minimum and maximum achieved scores were 27 and 82, respectively. The assessment score of injury of 14.0 % of the employees was less than 50, 30.5% between 50 and 60, 39.5% between 60 and 70 and 16.0% of the rest was more than 70. In other words, in the companies under study, about 40% of employees are working in critical occupations. Table 1 shows that the overall prevalence of current injury of samples was 23.5% (95% CI 17.6%,
The mean of number of injury by employee is 0.435 (95% CI 0.266, 0.604). Assuming a Poisson distribution for number of injured for sample employees, the expected number of zeros is 129. Therefore compared with 153 observed, 24 extra zero are observed relative to those expected under the Poisson assumption. Comparing NB and Poisson regressions shows that for these data NB is more appropriate ($P < 0.001$), with company correlated random effect, Xiang et al (25) score test value shows significantly zero-inflation against Poisson distribution ($P < 0.001$). In addition, the score test of Jansakul and Hinde (24) shows that there was extra zeros against NB regression ($P < 0.001$), however with company correlated random effect, Xiang et al (26) score test value shows that there is not significantly over-dispersion against zero-inflated Poisson regression.

Table 2 shows the result of fitting mixed ZIP regression model to number of injury by employees. At first, we considered full model with interactions between covariates. However, since interaction terms and other factors were not significant, Table 2 shows the model with main effects for significant factors. All factors were candidate to enter to this model. Hence age, education and work experience, are not included in the model, i.e. they are not related to number of injury by employees. Zero-inflated part of this model shows that supervisors (Adj. OR=0.004; $P < 0.001$) and technicians (Adj. OR=0.141; $P = 0.020$) have high chance of not to be injured at all relative to workers. In addition, this part of model indicates that employees with high score have less chance not to be injured at all than high score are (Adj. OR=0.925; $P = 0.039$). Under Poisson part of this model, married employers (Adj. RR= 4.735; $P = 0.001$) have high risk relative to singles to have more number of injured. The number of injured by supervisors (Adj. RR= 0.335; $P = 0.036$) and technicians (Adj. RR= 0.442; $P = 0.020$) are less than workers are. In addition, increasing assessment score decrease number of injuring of employees (Adj. RR= 0.938; $P < 0.001$). Furthermore a Pearson statistic for mixed effect of ZIP yields 187.049 on 186 degree of freedom ($P = 0.54$). Again, there is no evidence of lack of fit for the fitted model.

Table 1: Occupational injury frequency distribution of employees in one year (2007)

<table>
<thead>
<tr>
<th>Number of injury</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>153</td>
<td>77.0</td>
</tr>
<tr>
<td>1</td>
<td>33</td>
<td>16.6</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 2: Result of fitting ZIP regression random effects for occupational injury

<table>
<thead>
<tr>
<th>Variable</th>
<th>Poisson part</th>
<th>Zero-inflation part</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adj. RR* (95% CI)</td>
<td>P-value</td>
</tr>
<tr>
<td>Marital status (reference: Single)</td>
<td>4.735 (1.915, 11.711)</td>
<td>0.001</td>
</tr>
<tr>
<td>Job (reference: Worker)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technician</td>
<td>0.442 (0.222, 0.880)</td>
<td>0.020</td>
</tr>
<tr>
<td>Supervisor</td>
<td>0.335 (0.120, 0.931)</td>
<td>0.036</td>
</tr>
<tr>
<td>Manager</td>
<td>0.531 (0.204, 1.379)</td>
<td>0.194</td>
</tr>
<tr>
<td>Score</td>
<td>0.938 (0.914, 0.962)</td>
<td>0.000</td>
</tr>
<tr>
<td>$\sigma^2$ (Company)</td>
<td>0.877</td>
<td></td>
</tr>
<tr>
<td>deviance</td>
<td>159.623</td>
<td></td>
</tr>
<tr>
<td>Pearson statistic (DF)</td>
<td>177.674 (185)</td>
<td></td>
</tr>
<tr>
<td>-2log-likelihood</td>
<td>268.444</td>
<td></td>
</tr>
</tbody>
</table>

*Adjusted Relative Risk , **Adjusted Relative Risk
Discussion
This research is one of the few studies conducted of its kind in the Iran. A number of studies investigated some aspects of accidental behavior among industrial employees mostly on prevalence rates as well as prevention, control and determinants of accident without considering accident proneness (17-22). However, the aim of this study was to investigate the association between demographic factors and accident proneness scores with number of injuries by employees with using ZIP regression model. It was found that marital status, kind of jobs and score of employees are played an important role on number of injuries.

Workers in these companies were involved in critical occupations, for instance operators of crane, pressure welder and the roof plumber. They have high assessment score of accident proneness over 60. This mentioned group is more likely to be involved in injuries and have the high rate of unsafe behavior ratio. Concerning the nature of their work, the employment of this group of the individuals in critical occupations will be very much dangerous (28). In the companies under study, there were six instances of death, 5 of which included the after-mentioned critical occupations.

In this study, the highest score of accident proneness is considered for the occupational groups, which are more dangerous for first accident, for instance the groups of construction workers putting up scaffolding and drivers. Making a mistake can be very catastrophic in these jobs. This result indicates the more necessity of implementing controlling measures. However, there is indirect relation between increasing assessment score and number of injuries and it is conflict with other studies (29, 30).

The study re-emphasizes that it may be there are problems in married persons that these problems are risk factors for increasing injuries in married persons. Married persons with these problems need to be identified early to reduce the impact of these problems in the short and long-term. This will reduce the burden of injuries in employees, and may influence injuries that happen later.

The results of the study emphasize the need to screen the accident-prone individuals in the course of inspections and recruitment, assign them to less critical tasks, design and implement regular training and retraining sessions.

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References


