Profile, risk factors and outcome of occupational injuries reported to the emergency department in a tertiary care hospital in South India

Divya L. Regina¹, Kanagalakshmi V², Reginald George Alex¹
¹Department and Accident and Emergency Medicine, ²Community Medicine, Christian Medical College, Vellore, Tamil Nadu, India

ABSTRACT

Background: India is an industrialised country and most work is labour intensive. There is very scarce data on occupation related injuries. Aim: To evaluate the prevalence, profile, severity and risk factors for occupational injuries presenting to the emergency medicine department of a tertiary care hospital. Materials and Methods: A cross-sectional study was done in the emergency department of Christian Medical College, Vellore among the patients who presented with occupational injuries. The risk factors for occupational injuries like age, gender, shift work, work experience and type of work and their severity and outcome were evaluated. Results: Older age group, working in shift duty, working longer hours were significant risk factors for occupational injuries. Conclusion: Training and use of safety protective measures will decrease occupational injuries.

Keywords: Emergency, occupational injuries, risk factor, workplace

INTRODUCTION

India is a rapidly industrialising country that is developing at a fast rate. Tamil Nadu occupies an important place in the industrial development of India and therefore occupational injuries here are ever rising. The induction of sophisticated machinery and technology has eased human beings out of most sectors of working life, but the work of average men is still labor-intensive and involves hands-on work with machinery. In Turkey, an average of 70,000 to 80,000 workers per year visit health facilities due to occupational injuries. Among the trauma related injuries in the emergency departments of Pakistan, 28.7% were occupation related. The compensation for death and disability from work related injuries has increased from Rs 8 million to 186 million from 1961 to 1997. Data regarding occupational injuries are scarce in India. Hence, we have decided to evaluate the prevalence, profile, various risk factors, severity and outcome of occupational injuries presenting to the emergency department of a tertiary care hospital in southern India and this study is the first one on this subject in India.

METHODOLOGY

This study was conducted in the Emergency Department (ED) of Christian Medical College, Vellore, a tertiary care institution located in South India with 2800 inpatient beds and 7000 out-patient visits per day. The emergency department has 45 beds capacity with an average of 200 patients visiting daily. A cross sectional study was done among the patients presented to our ED with injuries related to their specific occupation.

Address for correspondence: Dr. Kanagalakshmi V, Department of Community Medicine, Christian Medical College, Vellore - 632 004, Tamil Nadu, India. E-mail: kanagasathish@yahoo.co.in

Received: 05-07-2020 Revised: 13-09-2020 Accepted: 02-10-2020 Published: 30-11-2020

HOW TO CITE THIS ARTICLE: Regina DL, Kanagalakshmi V, Alex RG. Profile, risk factors and outcome of occupational injuries reported to the emergency department in a tertiary care hospital in South India. J Family Med Prim Care 2020;9:5684-8.
Sample size was calculated as 300 considering the prevalence of occupational injuries among all injuries in emergency department (25%) and relative precision of 5%.

All patients from organized and unorganized industrial sectors, above the age of 18 who have sustained injury in the workplace and presented to ED were included. At arrival to the ED they were clinically evaluated and were triaged into three priorities according to the ED protocols for triaging.

The injuries have been classified as traumatic or non-traumatic. Traumatic injuries include direct mechanical like crushing/cutting injuries, fall from height, assault, etc., while non-traumatic include injuries due to exposure to chemicals, electricity, heat etc., The immediate management was given for all the patients as per ED protocol. Once the patients were stabilized, a semi-structured questionnaire was applied to all study patients or relatives, if the patients were sick after taking written consent. The questionnaire includes patient’s occupational profile (age, sex, occupation, time of injury, type of industry, details about the shift schedule, part time job, working hours, experience), specific mode of injury, time of injury, time of presentation to the emergency department, severity and description of injury, percentage in case of burns were collected. Severity of the injuries for trauma and non-trauma were assessed by using 2 separate scoring systems, Sequential Organ Failure Assessment (SOFA) score for non-trauma, Revised Trauma score (RTS) for trauma. Outcome from Emergency department, ward, ICU (stable and discharged, death, discharge against medical advice) were assessed.

For analysis, mean and standard deviation were calculated for continuous variables and categorical variables were presented as percentages. The association of risk factors was assessed using odds ratio and 95% confidence interval. Exact P values were computed using a Fisher's exact procedure. Multivariate analysis was done using binary logistic regression model incorporating significant exposure factors. Adjusted ORs with 95% confidence interval (CI) and two-sided tests of significance were calculated. Analysis of the data was done using the SPSS Version 17.0. The study was approved by the institutional review board of Christian Medical College, Vellore (IRB Min.No. 8286) and funded by Fluid research fund.

### Results

During the period of the study, a total of 304 patients reported to the emergency department with injury at workplace and out of which 300 patients were included in the study. The period prevalence of patient reporting to emergency department with injury at workplace is 0.67% (304 out of 45,362 patients). The description of the study population \( n = 300 \) is given in the Table 1.

Out of 300 patients, 275 were traumatic injuries, 18 were non-traumatic injuries and 7 patients sustained both traumatic and non-traumatic injuries. Age range was between 18-73 with mean 35.8 (SD = 13) and median 35 years. The working hours ranged from 3 to 14 hrs with median of 11.5 hours. Their work experience ranged from 1 to 40 yrs with median of 11.6 years.

The RTS score for trauma patients are as follows: 78% had mild injuries, 16% had moderate injuries, and 6% had severe injuries. The SOFA score for non-traumatic injuries (25 patients): 48% had mild injuries, 24% had moderate injuries and 28% had severe injuries.

Out of the 25 patients who sustained non-traumatic injuries, the site of injuries were thorax 10 (40%), Abdomen and pelvis 9 (36%), right hand 8 (32%), face and neck 8 (32%) and in traumatic patients were abdomen and pelvis 86 (31%), right hand 86 (31%), and left hand 80 (29%).

Considering the different occupation groups, the varying grades of injuries among those injured in each occupation is given in the Table 2.

The significant risk factors associated with varying grades of injuries in the workplace are shown in the Table 3. However, in the multivariate analysis working in shifts is the only significant risk factor for severe injury after adjusting for co-variables as shown in Table 4.

Among the 300 patients with occupational injuries, 17 patients were admitted to the ICU, 96 were admitted to the ward and

### Table 1: The description of the study population

| Parameter               | N (%) | N=300 |
|-------------------------|-------|-------|
| Sex                     |       |       |
| Male                    | 258 (86) |
| Female                  | 42 (14)  |
| Age at presentation     |       |       |
| 18-30 years             | 114 (38) |
| 31-44 years             | 102 (34) |
| >45 years               | 84 (28)  |
| Shift schedule          |       |       |
| Yes                     | 215 (71) |
| No                      | 85 (29)  |
| Working hours           |       |       |
| <8 hrs                  | 14 (5)   |
| >8 hrs                  | 286 (95) |
| Working experience      |       |       |
| <5 yrs                  | 109 (36) |
| 5-10 yrs                | 42 (14)  |
| 11-20 yrs               | 108 (16) |
| >20 yrs                 | 41 (14)  |
| Work place              |       |       |
| Quarry                  | 80 (27)  |
| Construction work       | 60 (20)  |
| Glass and chemical manufacturing | 30 (10) |
| Agriculture, forestry, fishing | 34 (11) |
| Electrical and plumbing | 37 (12)  |
| Others                  | 59 (20)  |
187 were treated in the emergency department as out-patients.

In our study, 143 patients were stable and discharged from Emergency department, 88 patients were discharged from ward and all 17 patients who were admitted in ICU subsequently improved and got discharged. There were 41 patients who got discharged against medical advice and 11 deaths.

Among the 11 patients who died, 10 had severe injuries and 1 had moderate injuries. Out of the 11 deaths, 10 occurred in the ED and 1 in the ward. The mortality was more among the electricians (11%) followed by agriculture related workers (6%). The other occupations were quarry and construction workers with less than 2% of all those who were injured. Severe injuries contribute to 43% of mortality among the electricians.

**Discussion**

Occupational injuries in India are on the rise, due to rapid industrialization. However, the knowledge and awareness regarding occupational injuries are still very limited. In our study, the point prevalence of occupational injuries among those reported in the emergency department was found to be 0.67%, while the prevalence of occupational injuries in the rural communities of India was 22.9%. The prevalence of occupational injuries among the injuries reported to tertiary teaching hospital in Ghana was 3%. This discrepancy is due to the fact that the study was conducted in a multispecialty tertiary care centre with wide range of emergency cases covering all specialities and also minor injuries from the workplace which would have either gone unreported or been treated in other hospitals. Also, other studies have shown that, among those with work-related injuries about 60% of them has seen primary care physician.

In our study, unskilled daily labourer in quarry (27%) and construction workers (20%) constituted the major number of occupational injuries. This has been similar to the findings in other studies done in various parts of world.

The majority of our patients with occupational injuries were males 258 (86%), and this finding correlates with the other studies (68%).

The injuries are more prevalent among the age group 18–30 (38%) similar to the other studies. The injuries may also be common among the younger age group due to lack of experience. Meanwhile, we also found that as age increases, the severity of injuries increases. Patient above the age of 35 have sustained more severe injuries when compared to patients below the age of 35. So increasing age is a risk factor for severe occupational injuries. Studies have shown that though the risk of injuries are less in older individuals, the injuries prove to be more fatal.

In our study, unskilled daily labourer in quarry (27%) and construction workers (20%) constituted the major number of occupational injuries. Studies have shown that jobs that require lifting heavy weights, kneeling, stooping and crouching has an increased risk of occupational injuries in elderly. This finding may represent that reduced physical capabilities (such as strength, balance, and processing speed) are associated with old age. Hence, aged workers should avoid heavy manual labour.

### Table 2: Distribution of severity of injuries within different occupations

| Occupation                          | Mild n (%) | Moderate to severe injuries n (%) |
|-------------------------------------|------------|----------------------------------|
| Electrical and plumbing work        | 22 (60)    | 15 (40)                           |
| Construction work                   | 44 (73)    | 16 (27)                           |
| Quarry                              | 64 (80)    | 16 (20)                           |
| Glass and chemical manufacturing    | 25 (83)    | 5 (17)                            |
| Agriculture                         | 29 (85)    | 5 (15)                            |
| Office                              | 46 (78)    | 13 (22)                           |

### Table 3: Risk factors associated with moderate to severe injuries in work place

| Risk factors | Moderate and severe | Mild | Odds ratio (CI) | P value |
|--------------|---------------------|------|----------------|---------|
| Age >35 yrs  | 46 (31.5%)          | 100 (68.5%) | 2.49 (1.42-4.35) | 0.001*  |
| Male         | 65 (25.2%)          | 193 (74.8%) | 2.49 (0.92-6.60) | 0.075   |
| Shift duty   | 59 (27.4%)          | 156 (72.6%) | 2.54 (1.26-5.13) | 0.007*  |
| Working >8 hrs a day | 69 (24.1%) | 217 (75.9%) | 4.13 (0.53-31.17) | 0.201   |
| Work experience, >10 yrs            | 22 (14.6%) | 129 (85.4%) | 2.79 (1.56-4.92) | 0.005*  |
| Repeated injury | 17 (34.7%) | 32 (65.3%) | 3.85 (1.02-3.85) | 0.044*  |

### Table 4: Multivariate analysis of risk factors

| Exposure factors | Odds ratio | CI      |
|------------------|------------|---------|
| Age>35 years     | 1.261      | 0.449-3.539 |
| Experience >10 years | 2.136 | 0.753-6.063 |
| Shift duty       | 2.395*     | 1.170-4.903 |
| Repeated episodes | 1.792     | –3.565  |

*Significant
The most common injury sites in trauma were abdomen and pelvis (31%) of patients, right hand (31%), and left hand (29%). The most common mode of injury in trauma was fall from height as most of the study population were from construction work.\[14\] The next common injuries were to the hand which occurred while handling heavy machineries.

The most common sites of non-traumatic injuries were thorax (40%), abdomen and pelvis (36%), right hand (32%), face and neck (32%). Most of non-traumatic injuries were due to electric shock. Most chemical injury splashes occurred over face and neck. This is similar to other studies were hand and abdomen are the common site of occupational injuries.\[15\]

In our study, 71% patients were on a shift schedule. Workers who are in shift schedule are 2.54 times more susceptible to occupational injuries.\[15\] This could be due to altered sleep pattern which causes change in circadian rhythm, depression and fatigability. Our study reports that, there was no significant difference in occupational injuries based on working hours. However, studies show working hours >8 hours/day raised the odds of occupational injury by 14.06 folds compared to those who work <8 hours.\[16\]

The median work experience was calculated as 10 years. Our study data shows that workers having more than 10 years of experience sustained more severe (32%) injuries. The risk of severity is increased by 2.8 times. This might be either due to over confidence in their work or due to aging factor.\[16\] However, studies found that, workers who did not undergo vocational training on their current work were 2.37 times more likely to have injury than those workers who underwent vocational training.\[17\]

Our study reports that, there were no significant difference in occupational injuries based on time of injury. Hence, time of injury is not a risk factor for occupational injuries. Our study depicts that 49 (17%) sustained repeated occupational injuries. Among them 17 (34.7%) had sustained severe injuries. Hence, repeated episode is a risk factor for occupational injuries. This can be explained by lack of awareness and negligence of safety measures.\[18,19\]

We found that mortality was more among the electricians 11% and most of them sustained severe injuries. Studies on electrical injuries show that higher mortality and morbidity are due to higher rate of medical complications and requiring greater number of surgical interventions.\[20-22\]

To summarize, occupational injuries are more common among construction and quarry workers and fall from height was most common mode of injury. Moderate to severe injuries are mainly among construction and quarry workers followed by those who work in electrical and plumbing. Shift duties, work experience more than 10 years, repeated injuries and age more than 35 are significant risk factors for severe work related injuries.

Primary care physicians not only make a diagnosis and prescribe treatment, but they also go to the extent of prognosis and assisting in rehabilitation and also suggesting the kind of work they can do after recovery.\[23\] They provide therapeutic as well as preventive services with regard to occupational injuries.\[8\] These findings of profile, risk factors and outcome of occupational injuries will help them manage workers with occupational injuries effectively at the first point of care.

### Limitations
Since this study was done in a tertiary care institution, mild workplace injuries would not have presented to this hospital. Also person with chronic occupational illnesses would have reported to our regular out-patient department rather than the ED and so would not have got included in the study. Hence, the study results could not be extrapolated to the community. Data regarding the use of Personal Protective, Equipment’s (PPEs) and formal training in their vocation and injury prevention measures were not collected in our study which could have been a bias in this study.

### Recommendations
Good practice guidelines with multidisciplinary approach at all level of staff including workers, supervisors, employers, safety personnel and occupational health physicians need to be implemented to prevent occupational injuries. The interventions need to be aimed at work place, equipment, job task, workers, and organizations. Adequate and periodical training especially on injury prevention and diligent use of personnel protective equipment’s need to be encouraged and made mandatory in both organized unorganized sectors. Adequate rest should be ensured for employees involved in shift work. Immediate availability and accessibility to an Occupational Physician should be made possible in all major workplaces.

### Conclusion
Since India is rapidly industrializing, occupational injuries are also on the rise both in the organized and un-organized sectors of industries and it is quite common among the younger age group. The risk factors for severe injuries in workplace are older age, working in shift duty, repeated episodes and work experience more than 10 years. Most of these injuries are preventable with proper training and education and appropriate use of PPEs and primary care physicians can play an important role in the prevention of occupational injuries. Hence, both Government and Private sectors should take necessary and active steps in implementing preventive strategies to mitigate these injuries in the workplaces.

### Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients
understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship
Fluid research grant, CMC.

Conflicts of interest
There are no conflicts of interest.

References
1. Ravi S, Joseph B. Incidence of occupational injuries among adults residing in a selected rural area of India: A cross sectional study. Pak J Med Sci 2019;35:737-42.
2. Celik K, Yilmaz F, Kavalci C, Ozlem M, Demir A, Durdu T, et al. Occupational injury patterns of Turkey. World J Emerg Surg 2013;8:57.
3. Ferreira FL, Bota DP, Bross A, Mélot C, Vincent J-L. Serial evaluation of the SOFA score to predict outcome in critically ill patients. JAMA 2001;286:1754-8.
4. Kondo Y, Abe T, Kohshi K, Tokuda Y, Cook EF, Kukita I. Revised trauma scoring system to predict in-hospital mortality in the emergency department: Glasgow coma scale, age, and systolic blood pressure score. Crit Care 2011;15:R191.
5. Blankson P-K, Amoako JKA, Asah-Opoku K, Odei-Ansong F, Lartey MY. Epidemiology of injuries presenting to the accident centre of Korle-Bu Teaching Hospital, Ghana. BMC Emerg Med 2019;19:39.
6. Won JU, Dembe AE. Services provided by family physicians for patients with occupational injuries and illnesses. Ann Fam Med 2006;4:138-47.
7. Sayhan MB, Sayhan ES, Yemenici S, Oguz S. Occupational injuries admitted to the emergency department. Pak Med Assoc 2013;63:179-84.
8. Breslin C, Koehoorn M, Smith P, Manno M. Age related differences in work injuries and permanent impairment: A comparison of workers’ compensation claims among adolescents, young adults, and adults. Occup Environ Med 2003;60:e10.
9. Salminen S, Perttula P, Ratilainen H, Kuosma E. The effect of demographic factors on occupational injuries. Int J Occup Saf Ergon 2017;23:225-8.
10. Varacallo M, Knoblauch DK. Occupational Injuries and Workers’ Compensation Management Strategies. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
11. Crawford JO, Graveling RA, Cowie HA, Dixon K. The health safety and health promotion needs of older workers. Occup Med 2010;60:184-92.
12. Fraade-Blanar LA, Sears JM, Chan KCG, Thompson HJ, Crane PK, Ebel BE. Relating older workers’ injuries to the mismatch between physical ability and job demands. J Occup Environ Med 2017;59:212-21.
13. Chau N, Bhattacherjee A, Kumar BM, Lorhandicap Group. Relationship between job, lifestyle, age and occupational injuries. Occup Med Oxf Engl 2009;59:114-9.
14. Tadros A, Sharon M, Chill N, Dragan S, Rowell J, Hoffman S. Emergency department visits for work-related injuries. Am J Emerg Med 2018;36:1455-8.
15. Cemalovic N, Rosic S, Toromanovic N. Analysis of the causes of occupational injuries and application of preventive measures. Mater Socio-Medica 2016;28:51-2.
16. Ryu J, Jung-Choi K, Choi K-H, Kwon H-J, Kang C, Kim H. Associations of shift work and its duration with work-related injury among electronics factory workers in South Korea. Int J Environ Res Public Health 2017;14:1429.
17. Tadesse S, Israel D. Occupational injuries among building construction workers in Addis Ababa, Ethiopia. J Occup Med Toxicol Lond Engl 2016;11:16.
18. Al-Thani H, El-Menyar A, Abdelrahman H, Zarour A, Consunji R, Peralta R, et al. Workplace-related traumatic injuries: Insights from a rapidly developing Middle Eastern country. J Environ Public Health 2014;2014:430832.
19. Zwerling C, Sprince NL, Wallace RB, Davis CS, Whitten PS, Heeringa SG. Risk factors for occupational injuries among older workers: An analysis of the health and retirement study. Am J Public Health 1996;86:1306-9.
20. Opara KO, Chukwuanukwu TO, Ogbonnaya IS, Nwadinigwe CU. Pattern of severe electrical injuries in a Nigerian regional burn centre. Niger J Clin Pract 2006;9:124-7.
21. Fordyce TA, Leonhard MJ, Watson HN, Mezei G, Vergara XP, Krishen L. An analysis of fatal and non-fatal injuries and injury severity factors among electric power industry workers. Am J Ind Med 2016;59:948-58.
22. Shih JG, Shahrokh S, Jeschke MG. Review of adult electrical burn injury outcomes worldwide: An analysis of low-voltage vs high-voltage electrical injury. J Burn Care Res 2017;38:e293-8.
23. Russian G, Brown JB, Stewart M. Managing injured workers: Family physicians’ experiences. Can Fam Physician Med Fam Can 2005;51:78-9.