

Prevalence of occupational injury and associated factors among workers in large-scale metal manufacturing factories in Addis Ababa, Ethiopia

Abate Benti^{1*}, Abera Kumie², Samson Wakuma²

Abstract

Background: Worldwide work related injuries are becoming serious public health problems. However, very limited attempts have been made to assess the prevalence and factors associated with work-related injuries in Ethiopia.

Objectives: The aim of this study was to assess the prevalence of occupational injury and associated factors among workers in large-scale metal manufacturing factories in Addis Ababa, Ethiopia.

Methods: An institutional-based cross-sectional study was carried out among 588 metal workers in Addis Ababa, Ethiopia. Five metal factories were involved in the study. Data were collected using structured questionnaires, clinical data reviews and an observational checklist. Descriptive and multivariable analyses were done to describe the study population and identify risk factors associated with injury using an odds ratio with a 95% confidence interval (CI).

Results: The prevalence of occupational injury among workers in the metal factories was 291 (49.9%) [95%CI: 45.8-53.9] per year. Among those injured respondents, 149 (51%) were not wearing personal protective equipment (PPE) at the time of injury. The use of PPE [adjusted odds ratio (AOR)=4.84; 95%CI: 2.93-8.01], attending primary school only [AOR=5.64; 95%CI: 3.05-10.43] and having 11 to 20 years' work experience [AOR=7.878; 95%CI: 2.60-23.90], were major predictors of work-related injury after adjusting for confounding factors. There were 18 recorded incidents resulting in major disabilities in one factory during the study period.

Conclusions: The prevalence of occupational injury among metal workers was high. The use of PPE, attending primary school and those who had 11 to 20 years work experience were major predictors of work related injury. There is a need of provide an adequate supply of PPE for all metal workers and to ensure that they use it. [*Ethiop.J. Health Dev.* 2019; 33(2):94-101]

Key words: Work related injury, health and safety, factory workers, occupation, personal protective equipment utilization

Introduction

Work-related injury is an incident resulting from an occupational accident (1) that is commonly accompanied by body damage, such as cuts, fractures, sprains, or amputation of limbs. Worldwide work related injuries are becoming serious public health problems (2). According to Global Estimates of Occupational Accidents and Work-related Illnesses (2014) globally there was 313 million work related injuries (3).

Higher rates of injuries occur in low-income countries, including sub-Saharan Africa, compared to high-income countries (4). This is mainly because the focus on occupational health and safety, including the prevention of occupational injuries, is very limited in low-income countries (5). For example, according to Ergör *et al.*, 80% of the workforce in developing countries is involved in heavy and dangerous work (6). However, only 5-15% of this workforce has access to occupational health services (6).

Like many other African and low-income countries, occupational injury is high in Ethiopia, based on limited evidence. For example, an old study conducted in Akaki textile factory found 143 accidents during the study period, giving an incidence density of 200 per 1,000 person years (7). A report from Amhara regional state Bureau of Labour and Social Affairs in

2007/8 indicated a high incidence rate of occupational injury in Bahir Dar and Kombolcha textile factories (8). A recent study conducted among building construction workers in Addis Ababa indicated that the prevalence of injury was 38.3% in the past year (9). A study conducted in

iron and steel industries in Addis Ababa indicated that the injury prevalence rate was 33.3% per year (10). According to the latter study, the most common causes of injury were splitting and flying objects, and being hit by falling objects and machinery.

Available studies indicate that various factors are associated with occupational injury. These factors include: lack of personal protective equipment (PPE) (9,10), poor protective measures on the machinery, poor implementation of occupational safety and health policy, lack of education (11), lack of safety training (7), alcohol consumption (12) and sleeping disorders (13).

Metal and engineering industries in Ethiopia are considered as the primary industries to contribute to industrial development and are expected to play an important role in the gross domestic product growth of the country (14). This means that the metal industries are expected to involve a large workforce. Working in such industries exposes workers to a high risk of injury

^{1*} Ministry of Health, Directorate of Environmental Health, Ethiopia. Email - AB: abatebenti@yahoo.com

² Department of Preventive Medicine, School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia. Email - AK : aberakumie2@yahoo.com, SW: samson_wakuma@yahoo.com

as it involves working with heavy materials and machinery.

There are only two studies of metal industries in Ethiopia that assessed the prevalence of injury and associated factors. One of the studies focused on small and medium-scale industries in Gondar (9) and the other addressed iron and steel industries workers in Addis Ababa, in Akaki Kality sub-city only (10), so this may not be representative of all large-scale metal factories in the capital. Furthermore, previous studies often did not include clinical data from health institutions based in the metal factories.

The aim of this study was to assess the prevalence of occupational injury and associated factors among workers in large-scale metal manufacturing factories in Addis Ababa, Ethiopia. This study will add knowledge for use by the scientific community and occupational health and safety program implementers and policy makers to design strategies needed for the prevention and control of occupational injuries in the Ethiopian metal industry sector.

Methods

Study setting: There are 35 large-scale metal manufacturing factories in Addis Ababa. This study was conducted in five of these factories.

Study design and period: An institution-based cross-sectional study was carried out among workers in the five factories from August to October 2016.

Study population: Metal workers who were directly engaged in the front line of metal production sections were the study population. Workers who were ill and unavailable for communication were excluded from the study.

Sample size determination: The sample size was determined using single population proportion formula for the prevalence of occupational injury and double population proportion formula for determinants. A total of 588 metal production workers were included in the study.

Sampling technique: The list of existing large-scale metal factories in Addis Ababa was obtained from Addis Ababa Bureau of Labor and Social Affairs and the Metal Industry Development Institute of the Ministry of Industry (15). Five metal factories were randomly selected. The number of participants were allocated proportionally to the number of workers in the five metal factories. Participants were selected by systematic random sampling method, using the workers' registration list as a sampling frame.

Data collection tools and procedures: Data were collected using a structured questionnaire adopted from previous research (16). The questionnaire covered socio-demographics, behavioural issues, working environment, and PPE utilization. Face-to-face interviews with the participants were used to collect the data. Prior to the actual data collection, a pre-test was conducted in 5% of the total sample size in one of the

metal factories to validate the collection tool. Questions that were not easy for the participants to understand were rephrased to make them more easily understood. An observation checklist was used to assess the workplace environment. Injury-related data was reviewed and documented from the records of factory clinics to assure the status of occupational injuries within a one-year period.

Study variables:

Dependent: Occupational injury

Independent: Socio-demographic factors: age, sex, religion, marital status, level of education, monthly income, employment condition, work experience.

Work environmental factors: Health and safety training, workplace supervision, work shift.

Workers' behavioral factors: Alcohol consumption, chat chewing, cigarette smoking, sleeping disorder, job stress and PPE use.

Operational definitions of variables

Large-scale metal manufacturing factory: Factory that employees 250 or more workers and uses power-driven machines (16).

Health and safety information: Information in a one-year period that is transmitted via any medium about health and safety issues involved in working in a factory (7).

Health and safety training: Short-term training given on health and safety to factory workers (11).

Workplace supervision: Regular supervision done by health and safety professionals/supervisors who received short-term training on health and safety (11).

Chat chewing: Chewing chat leaves at least once per week for different purposes (11).

Cigarette smoking: The practice of smoking cigarettes regularly (11).

Sleeping disturbance problem: The presence of sleeping problems when the worker is at work in the factory (11).

Alcohol consumption: Consumption of any kind of alcohol at least two times per week (17).

Occupational injury: Any physical injury which is reported by the respondent in connection with the performance of their work in the metal manufacturing factory in the past one year and in the past two weeks.

Personal protective equipment: Specialized clothing or equipment (such as goggles, gloves, ear plug, masks, helmets, face shield, boots, protective clothing) worn by employees for protection against related health and safety hazards at the time of interview (11). Personal protective equipment is designed to protect many parts of the body, such as eyes, head, face, hands, feet, and ears.

Data management and analysis: Data were entered into Epi Info Version 7.0, cleaned, and analyzed in SPSS. Descriptive statistics was done to determine the prevalence of work-related injury in metal factories and to characterize the variables. Results were presented using tables and pie charts.

Bivariate and multivariable analyses were done to identify factors which were related to injury. Those variables that indicated a significant association with injury in the bivariate analysis were considered for the multivariable analysis. Results were presented using crude odds ratios (COR) and adjusted odds ratios (AOR) with 95% confidence intervals.

Ethical clearance: Ethical clearance and a formal letter of cooperation was obtained from the Ethical Review Committee of Addis Ababa University School of Public Health. Verbal consent was obtained from a participants after a necessary explanation about the purpose, benefit and risk of the study and also their right to decide whether or not to participate in the study. The study participants were informed that there was no any direct financial benefit or risk from the study, and that the study findings would be used to

design strategies for injury prevention and control mechanisms among metal workers in metal factories. Concerning confidentiality, the names of the respondents was not included in the questionnaire.

Results

Socio-demographic characteristics of the respondents: A total of 583 participants responded, making the response rate 99.1%. Of these, 514 (88.2%) were male. The majority of participants (55%) were in the age range 18-30 years, and 437 (75%) professed to be Orthodox Christians. More than half of the participants (306) had attended secondary school (Table 1). Most participants (52%) were married and 74 (13%) had 21 to 30 years' work experience (Table 1). In terms of income, around half (286) earn 2,000 Birr or less per month, while the remaining participants earn more than 2,000 Birr (Table 1).

Table 1: Socio-demographic characteristics of participants (n=583) in the selected metal factories in Addis Ababa

| Variables | | Frequency(n) | % |
|--------------------------|-------------------------|--------------|------|
| Sex | Male | 514 | 88.2 |
| | Female | 69 | 11.8 |
| Age in years | 18-30 | 319 | 54.7 |
| | 31-44 | 134 | 23.0 |
| | 45+ | 130 | 22.3 |
| Religion | Orthodox | 437 | 75.0 |
| | Muslim | 48 | 8.0 |
| | Protestant | 86 | 15.0 |
| | Other | 12 | 2.0 |
| Educational level | Read and write | 12 | 2.1 |
| | Primary school (1-8) | 118 | 20.2 |
| | Secondary school (9-12) | 306 | 52.5 |
| | Above secondary school | 147 | 25.2 |
| Marital status | Married | 301 | 51.6 |
| | Single | 266 | 45.6 |
| | Divorced | 7 | 1.2 |
| | Widowed | 9 | 1.5 |
| Employment status | Indefinite | 458 | 78.6 |
| | Definite | 125 | 21.4 |
| Work experience | ≤ 10 yrs | 410 | 70.3 |
| | 11-20 | 67 | 11.5 |
| | 21-30 | 74 | 12.7 |
| | 31+ | 32 | 5.5 |
| Income per month | ≤2,000 Birr | 286 | 49.1 |
| | 2,001-4,000 Birr | 213 | 36.5 |
| | ≥4,001 Birr | 84 | 14.4 |

Work environment characteristics: Regarding the working environment, 267 (45.8%) respondents had regular supervision at the workplace. Four hundred and forty two (75.8%) of the respondents did not attend any

kind of workplace safety training. Four hundred and seventy eight (82%) of the participants had no work shift arrangement. The majority (494) of respondents worked more than 40 hours per week (Table 2).

Table 2: Workplace characteristics of participants (n=583) in the selected metal factories in Addis Ababa

| Variables | | Frequency (n) | % |
|-----------------------------------|-----|---------------|------|
| Presence of workplace supervision | Yes | 267 | 45.8 |
| | No | 316 | 54.2 |
| Presence of work shift | Yes | 105 | 18.0 |
| | No | 478 | 82.0 |
| Health and safety information | Yes | 276 | 47.3 |
| | No | 307 | 52.7 |
| Health and safety training | Yes | 141 | 24.2 |
| | No | 442 | 75.8 |
| Work hours per week | ≤40 | 89 | 15.3 |
| | >40 | 494 | 84.7 |

Behavioral characteristics: Regarding the behavioral characteristics of the respondents, 559 (96%) did not chew chat and 532 (91%) had no sleeping disorders.

The majority of the respondents (86%) had no job stress and 78% use PPE regularly (Table 3).

Table 3: Behavioral characteristics of respondents (n=583) in the selected metal factories in Addis Ababa

| Variables | | Frequency (n) | % |
|-------------------|-----|---------------|------|
| Smoke cigarettes | Yes | 23 | 3.9 |
| | No | 560 | 96.1 |
| Drink alcohol | Yes | 29 | 5.0 |
| | No | 554 | 95.0 |
| Chew chat | Yes | 24 | 4.0 |
| | No | 559 | 96.0 |
| Sleeping disorder | Yes | 51 | 8.8 |
| | No | 532 | 91.2 |
| Job stress | Yes | 79 | 13.6 |
| | No | 504 | 86.4 |
| Regularly use PPE | Yes | 456 | 78.2 |
| | No | 127 | 21.8 |

Work-related injuries among respondents: The prevalence of work-related injuries among the respondents in metal factories was 49.9% [95%CI: 45.8-53.9]. Among those 291 who had a work-related injury in the past 12 months, 72 (24.7%) had suffered an injury in the past two weeks. The two weeks' prevalence of injury was 12.3% [95%CI: 9.6-15.1]. Among those who had an injury, 200 (68.8%) had experienced an injury more than once (Table 4).

In terms of body parts affected, 191 (66%) had injured their hands, and 169 (58%) had injured their fingers. Only nine (3%) and five (2%) injuries occurred in lower and upper arms, respectively (Table 4).

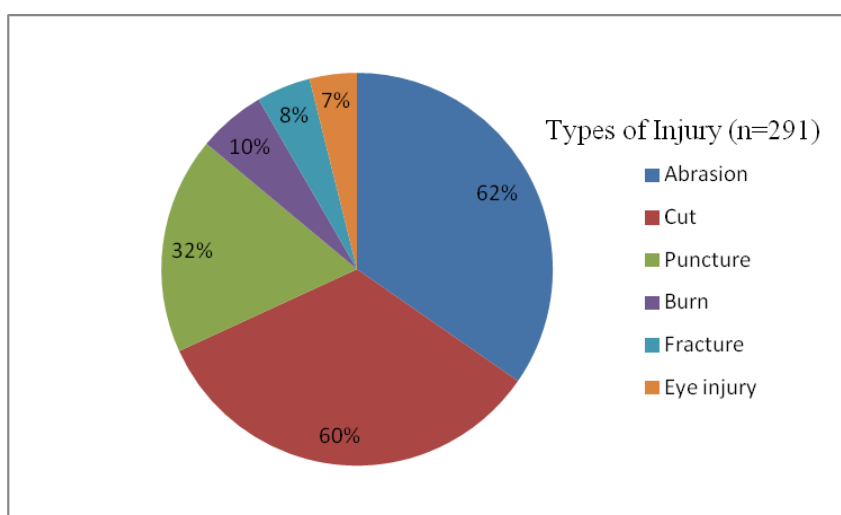
Among those injured respondents, 149 (51%) were not wearing personal protective equipment (PPE) at the time of injury. The main reason for not wearing PPE mentioned by respondents (111, 75%) was that there was no PPE available. One hundred and thirteen (39%) respondents perceived not using PPE as a reason for sustaining an injury, followed by accidents beyond their control (72, 25%), and the nature of the work meant that it was not convenient to use PPE (32, 11%) (Table 4).

Looking at the sources of injury, machinery was the main factor (219, 75%), followed by lifting heavy objects (36, 12%) and electricity (21, 7%) (Table 4).

Table 4: Work-related injuries among respondents (n=583) in the selected metal factories in Addis Ababa in the past 12 months

| Variables | Responses | Frequency(n) | % |
|------------------------------------------------|-----------------------------|--------------|------|
| Injury in the past 12 months | Yes | 291 | 49.9 |
| | No | 292 | 50.1 |
| Injury in the past two weeks(n=291) | Yes | 72 | 24.7 |
| | No | 219 | 75.3 |
| Occurrence of injury (n= 291) | Once | 91 | 31.2 |
| | More than once | 200 | 68.8 |
| Parts of body affected (n=291) | Hand | 191 | 65.6 |
| | Fingers | 169 | 58.0 |
| | Toe | 52 | 17.9 |
| | Eye | 22 | 7.6 |
| Use of PPE at the time of injury | Lower arm | 9 | 3.0 |
| | Upper arm | 5 | 1.7 |
| | Yes | 142 | 48.8 |
| Reason for not using PPE(n=149) | No | 149 | 51.2 |
| | Lack of PPE | 111 | 74.5 |
| Perceived reasons for sustained injury(n= 291) | Not comfortable to use PPE | 38 | 25.5 |
| | Not using PPE | 113 | 38.8 |
| | Accident was beyond control | 72 | 24.7 |
| | Work nature | 32 | 11.0 |
| Sources of injury (n=291) | Do not remember | 18 | 6.2 |
| | Machinery | 219 | 75.3 |
| | Lifting heavy objects | 36 | 12.4 |
| | Electricity | 21 | 7.2 |
| | Hand tools | 10 | 3.4 |
| | Fire | 9 | 3.0 |
| | Falling objects | 6 | 2.0 |

Types of injury: Among the 291 injured, the common types of injuries were abrasions (62%), cuts (60%) and punctures (32%)(Figure 1).

**Figure 1: Type of injuries in metal factories in Addis Ababa, Ethiopia**

Multivariable analysis results: Participants who did not use PPE regularly during work were 4.84 times more likely to be injured than workers who used PPE [AOR=4.84; 95%CI: 2.93-8.01]. Participants who had 11 to 20 years' work experience [AOR=7.88; 95%CI: 2.60-23.90] and less than 10 years' work experience

[AOR=3.62;95%CI:1.21,10.82] showed significant association with occupational injury in the multivariable analysis after adjusting for confounding factors (Table 5). Participants aged between 18 and 30 years and participants who had no job stress were less

likely to suffer injuries compared to those above 45 years and who had job stress, respectively (Table 5).

Table 5: Multivariable logistic regression analysis of factors associated with work-related injuries

| Variable | | Injury | | Crude OR [95% CI] | Adjusted OR [95% CI] |
|----------------------------|--------------------------------|--------|-----|-------------------|----------------------|
| | | Yes | No | | |
| Age | 18-30 | 143 | 176 | 0.54 (0.36,0.82)* | 0.42 (0.19,0.95) * |
| | 31-44 | 70 | 64 | 0.73 (0.45,1.19) | 0.52 (0.25,1.07) |
| | 45+ | 78 | 52 | 1 | 1 |
| Education | Read and write | 7 | 5 | 3.75(1.12,12.48) | 1.757 (0.46,6.78) |
| | Primary (Grades 1-8) | 79 | 39 | 5.42 (3.20,9.19)* | 5.64 (3.05,10.43) * |
| | Secondary school (Grades 9-12) | 165 | 141 | 3.13 (2.04,4.80)* | 4.20(2.57,6.88) * |
| | Above secondary | 40 | 107 | 1 | 1 |
| Marital status | Married | 169 | 132 | 0.58 (0.41,0.81)* | 0.32 (0.05,2.01) |
| | Single | 113 | 153 | 1.04 (0.23,4.73) | 0.40 (0.06,2.67) |
| | Divorced | 4 | 3 | 0.98 (0.26,3.71) | 0.38 (0.03,5.74) |
| | Widowed | 5 | 4 | 1 | 1 |
| Employment status | Definite | 56 | 69 | 0.77 (0.52,1.15) | |
| | Indefinite | 235 | 223 | 1 | |
| Work experience | ≤10 yrs | 191 | 219 | 2.35 (1.36,4.05)* | 3.62 (1.21,10.82) * |
| | 11-20 yrs | 45 | 22 | 1.28 (0.78,2.10) | 7.88 (2.60,23.90) * |
| | 21-30 yrs | 39 | 35 | 1.15 (0.56,2.36) | 2.30 (0.88,6.02) |
| | 31+ | 16 | 16 | 1 | 1 |
| Income | ≤ 2,000birr | 132 | 154 | 0.71 (0.43,1.15) | |
| | 2,001-4,000 birr | 113 | 100 | 0.93 (0.56,1.55) | |
| | ≥ 4,001 | 46 | 38 | 1 | 1 |
| Workplace supervision | No | 171 | 145 | 1.45 (1.04,2.00)* | 0.83 (0.56,1.23) |
| | Yes | 120 | 147 | 1 | 1 |
| Health and safety training | No | 226 | 216 | 1.22 (0.84,1.79) | |
| | Yes | 65 | 76 | 1 | 1 |
| Alcohol consumption | No | 273 | 281 | 0.59 (0.28,1.28) | |
| | Yes | 18 | 11 | 1 | |
| Job stress | No | 241 | 263 | 0.36 (0.20,0.63)* | 0.38 (0.21,0.67) * |
| | Yes | 50 | 29 | 1 | 1 |
| Regular use of PPE | No | 94 | 33 | 3.75 (2.42,5.80)* | 4.84 (2.93,8.01) * |
| | Yes | 197 | 259 | 1 | 1 |

*P<0.05; '1': Reference

Results from workplace observation

Availability of health and safety regulations: In two metal factories, warning signs and safety rules were posted on the wall in each work section, although three metal factories had no warning signs or lists of safety rules to be observed. No documents relating to health and safety regulations were found in any of the five metal factories.

PPE utilization: Some workers do not use PPE while on duty.

Availability of safety officers and safety committee: Clinical nurses and health officers were assigned as safety officers in three metal factories, and in one metal factory a mechanical engineer was assigned as a safety officer. All assigned safety officers had received no

training on occupational health and safety. Four of the metal factories had health and safety committees, but they were not active. This may be because little attention is given by the management to the health and safety program. In one metal factory, no health and safety committee had been established.

Results from clinical data review

Four metal factories have their own clinic, and one factory used a private clinic in the local area. Based on a review of one year's clinical records, the common types of minor injuries identified were punctures, abrasions, cuts, dislocations, bone fractures, burns, tooth fractures, eye injuries, and muscle damage. The body parts affected were back, eye, hand, lower leg, toe, chest, finger, waist and teeth. Regarding major physical injuries, in one of the metal factories, there

were 18 workers amputated limbs and fractured their hands, legs, fingers in one year, and these workers were certified by the medical board as being permanently disabled.

Discussion

Worldwide, work-related injuries are considered as a major public health problem. This institutional-based cross-sectional study was conducted to assess the prevalence of occupational injury and associated factors among workers in large-scale metal factories.

The 12 months' prevalence of injury was 291(49.9%). This finding is consistent with studies conducted in Addis Ababa metal factories and in Mekele small-scale industry, which show the prevalence of occupational injury as 48.9% and 58.2%, respectively, in one year(16,18). The current study also shows that 72 (24.7%) workers had an injury in the past two weeks.

This study showed 291 self-reported injuries, the majority of which were abrasions and lacerations(62%), followed by cuts (60%). This finding agrees with studies conducted in another Addis Ababa metal factory(16) and a study in coastal south India (19).

Respondents who attended primary and secondary school only had increased odds of work-related injury, compared to those who had an educational level above secondary school, and the association was statistically significant. This finding is consistent with findings from another study in Addis Ababa(10). This may be explained by the assignment of workers in factories where employees with low educational status are placed in less technical and relatively dangerous work. Furthermore, having a higher education may help to make workers aware of safety precautions.

In terms of work experience, those who had less work experience were more likely to have a work-related injury compared to those respondents who had more years' work experience, and the association was statistically significant. This might be due to more experienced employees being adapted to the working environment and complying with safety precautions. However, this finding is not in line with a study of building construction workers in Addis Ababa(9). The different findings might be explained by the difference in study settings.

Respondents who had no job stress were less likely to have a work-related injury compared to those who had job stress, and the association was statistically significant. This finding corroborates the findings of a study of steel and iron factories in Addis Ababa, where workers who had stressful jobs had higher rates of injury(10). This might be because workers with job

stress may have different problems such as loss of concentration, sleep disturbances, poor recall and negligence of work-related hazards.

Respondents who did not use PPE regularly were more likely to have a work-related injury. This finding is consistent with other studies (9,10). This could be explained by the fact that the proper utilization of PPE highly reduces the occurrence of unexpected injuries in metal factories. Although this fact is well established in safety science, the practice of using PPE is very limited in metal industries in Addis Ababa.

Results from workplace observation indicate that four of the metal factories had health and safety committees, but they were not active. This may be because little attention is given by the management to the health and safety program. However, Labour Proclamation No. 377/06, Article 92, clearly states that the employer has fundamental obligations with regard to putting in place all the necessary measures, including a health and safety committee, in order to ensure workplaces are safe, healthy and free from any danger to the wellbeing of workers (20).

The results from medical review, particularly in terms of the types of injuries and body parts affected, were consistent with the results found in the questionnaire interview.

Limitations of this study

This study used a questionnaire-based interview to assess the prevalence of injury, which exposes the findings to potential recall and interviewer bias. This might have underestimated or over-exaggerated the findings.

Conclusions

This study concludes that the prevalence of occupational injury among metal workers was high. The use of PPE, educational level and work experience were major predictors of work-related injury.

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Competing interest

The authors declare that they have no any financial competing interests or any conflicts in relation to this publication.

Authors' contributions

AB carried out protocol development, data collection, data management and analyses, and wrote the manuscript. AK and SW were involved in protocol development, providing field work monitoring, and support, and editing the manuscript.

References

1. International Labour Organization. Resolution concerning statistics of occupational injuries. 1998 www.ilo.org/wcmsp5/groups/public/---dgreports/-stat/documents/normativeinstrument/wcms_087528.pdf
2. Hämäläinen P, Leena Saarela K, Takala J. Global trend according to estimated number of occupational accidents and fatal work-related diseases at region and country level. *J Safety Res.* 2009;40(2):125-39.
3. Nenonen N, Saarela KL, Takala J, Manickam K. Global estimates of occupational accidents and work-related illnesses 2014. Singapore: Workplace Safety & Health Institute; 2014. Available at: https://www.researchgate.net/publication/265214122_Global_Estimates_of_Occupational_Accidents_and_Workrelated_Illnesses_2014_made_for_the_ILO_Report_at_XX_World_Congress_Frankfurt
4. Eijkemans G. WHO and ILO joint effort on occupational health and safety in Africa. *Afr. Newslett. Occup. Health. Saf.* 2004;14(2):28-9.
5. Mohammadfam I, Moghimbeigi A. Evaluation of injuries among a manufacturing industry staff in Iran. *Journal of Research in Health Sciences.* 2009;9(1):7-12.
6. Ergör O, Demiral Y, Piyal Y. A significant outcome of work life: occupational accidents in a developing country, Turkey. *J Occup Health* 2003;45(1):74-80.
7. Senbeto E. The incidence of injuries and their determinants in Akaki textile factory. Master's thesis. Addis Ababa University, 1991.
8. Amhara National Regional State Bureau of Labour and Social Affairs: Employment accident statistics. Bilingual Annual Bulletin, 2007/8.
9. Tadesse S, Dagnachew I. Occupational injuries among building construction workers in Addis Ababa, Ethiopia. *Journal of Occupational Medicine and Toxicology.* 2016;11:16.
10. Kifle M, Engdaw D, Alemu K, Rai Sharma H, Amsalu S, Feleke A, *et al.* Work related injuries and associated risk factors among iron and steel industries workers in Addis Ababa, Ethiopia. *Safety Science.* 2014; 63:211-6.
11. Aderaw Z, Engdaw D, Tadesse T. Determinants of occupational injury: a case control study among textile factory workers in Amhara Regional State, Ethiopia. *Journal of Tropical Medicine.* 2011(2):657275.
12. Bhattacherjee A, Chau N, Sierra CO, Legras B, Benamghar L. Relationships of job and some individual characteristics to occupational injuries in employed people: a community-based study. *J Occup Health.* 2003;45:382-91.
13. Salminen S, Oksanen T, Vahtera J, Sallinen M, Harma M. Sleep disturbances as a predictor of occupational injuries among public sector workers. *J Sleep Res.* 2010;19:207-13.
14. Federal Democratic Republic of Ethiopia. Growth and Transformation Plan II (GTP II) (2015/16-2019/20). Addis Ababa: National Planning Commission, 2016.
15. Metal Industry Development Institute. Annual report for the year 2013. Addis Ababa, Ethiopia, 2013
16. Yitagesu H. Assessing of magnitude and factors of occupational injury among workers in large scale metal manufacturing industries in Addis Ababa. Addis Ababa: Addis Ababa University, 2010.
17. Berhe A, Yemane D, Gebresilassie A, Terefe W, Ingale L. Magnitude of occupational injuries and associated factors among small scale industry workers in Mekele city, North Ethiopia. *Occupational Medicine and Health Affairs.* 2015;3:197.
18. Berhe A, Yemane D, Gebriselassie A, Terefe W, Ingale L. Magnitude of occupational injuries and associated factors among small-scale industry workers in Mekelle City, Northern Ethiopia. *Occupational Medicine and Health Affairs.* 2015; 3(3).
19. Kumar SG, Dharanipriya A. Prevalence and pattern of occupational injuries, at work place welders in costal south India: *Indian Journal of Occupational and Environmental Medicine.* 2014;18(3):135-9.
20. Ministry of Labour and Social Affairs. Occupational safety and health profile for Ethiopia. Addis Ababa, 2006