Original Research Article

Determinants of Occupational Injury among Building Construction Employees in Southeastern Ethiopia

Abstract

Introduction: An occupational injury is the most principal cause of work absenteeism, disability, retirement, mutilation, and mortality. Therefore, injuries in the workplace pose a major public health and developmental problems especially in developing countries, which causes a serious health, social, and economic costs on labor force and their companies. The present study identified the prevalence of injury and its determinants among building construction employees in Robe town, Ethiopia.

Methods: An institutional-based cross-sectional study was conducted among building construction employees in Robe town from March 01-25/2017. A simple random sampling technique was used to select the study participants. The data was entered to Epi data 3.1 and analyzed by using SPSS version 20 software. Face to face interview was conducted on 402 respondents using structured and pretested questionnaire. Bivariate and multivariate logistic regression analysis was performed to identify the effect of explanatory variables on injury. **Results:** The prevalence of injury among building construction employees was reported to be 39.2% [95 % CI: (34.4, 44.2)] in the past one year. The three leading causes of injuries were fall from the same level, 38.5% followed by injuries caused by movable or falling objects, 23.1% and fall from elevation 13.4%. Being male, use of personal protective equipment, health and safety training, regular supervision and job satisfaction were factors significantly associated with injury.

Conclusion: This study reported relatively higher prevalence of injury among building construction workers compared to other studies. Factors such as being male, working without using personal protective equipment, absence of health and safety trainings, lack of regular supervision and job dissatisfaction were associated with significantly higher levels of occupational injury among construction workers. Therefore, the employer should focus on areas, such as provision of safety trainings, promoting use of personal protective equipment during work, plan regular workplace supervision, and satisfy their employees by creating good work environment and working situation to mitigate the burden of occupational injuries.

Key words: Occupational injury, building construction, employees, health and safety

1. INTRODUCTION

An occupational injury is defined as any physical damage situation sustained on an employee in association with the performance of his or her task in the work place [1] . It is the most principal cause of work absenteeism, disability, retirement, mutilation, and mortality [3]. Injuries in the work place pose a major public health and developmental problems which cause a serious health, social, and economic costs on labor force and their companies [2]. The cost accounts to four percent of the world's gross domestic product (GDP) (about 1.25 trillion USD) [3].

Occupational injuries related to construction job remain a big problem in the world [4]. Globally, 17 percent of all occupational deaths are in the construction sector [5,6]. According to health and safety statistics, in UK the construction industry had the second highest percentage of self-reported illness accredited to occupation at 3,800 cases per 100,000 working individuals [7]. Therefore, employees in the construction sector have a high total death rate, autonomous of social class, by bricklayers and manual workers being documented as having the second highest death rate, [25]. The construction company has particular hazards to the sector alone such as working in a complex environment as both the place of work and the labor force are non-static, work at heights, work with power tools, lack of regulation and application than other sectors, more than one job and above one employer working on a single site with absence of coordination, a site involves strictly different activities by generating dissimilar hazards, the sector dominantly engage impermanent, unorganized and illiterate employees with cheap payment, informal employees-employer relationships, lack of standards or regulations among employees in terms of expertise in their skill and training standards [8, 25]. These reasons made the construction company the most hazardous work place and it contributes large number of injuries and deaths than other manufacturing industries. It is subject to high rates of work absenteeism, occupational accidents and diseases due to the presence of high exposure to physical, psychosocial, mechanical, biological, chemical and ergonomic risk factors in the sector [3]. So that, injuries and fatalities in the construction company have been associated with significant economic costs [7]. Annually, over 10 billion USD has been used up for direct and indirect occupational injury costs. Above 1.36 billion USD has also been used for medical expanse to nonfatal injuries, [9].

The construction industry is also an emergent industry of the world, comprise 7.5% of the total work force and it contributes major economic movement following agricultural sector, for the socio-economic and infrastructure development goals are attained only by the contribution of construction sector [25]. The construction manufacturing is an area that changes various resources into social infrastructure necessary for socio-economic development [10]. It holds a large number of people on its workforce meeting the demands of fast and targeted growing [25]. Therefore, 44% of urban unorganized employees are engaged in this sector after agriculture, [6].

The effects of work-related health and safety hazards encountered by construction employees in unindustrialized countries are ten to twenty times higher than those in developed countries [2]. Ethiopia is one of the developing countries that are currently enjoying a strong growth in construction activities such as, building schools, hospitals, housing complexes, shops, offices, highways, power plants, industries, bridges and other infrastructures [9]. However, all these lucrative construction activities are done by low income employees, illiterate, unskilled, and unorganized workers by cheap payment in unsafe work environment and absence of implementation of occupational health and safety laws [11]. Poor design of work stations and tools; absence of personal protective equipment, lack of supervision, and inadequate training of workers, unsafe working environments are the major cause of most occupational injuries especially in developing countries [12]. In addition, young age, male sex, lack of formal education, lack of experience, job dissatisfaction, smoking, chewing, excess alcohol use, sleeping problems, prolonged working hours, and non-use of personal protective equipment are essential individual factors among construction workers, [13, 25].

In Ethiopia, little work has been done on work-related health and safety issues, especially on building construction employees. The prevalence of work-related injuries among building construction employees in Addis Ababa city is identified to be 84.7% [3], and in Gondar town 38.7% [13]. Still the occupational problems of construction sectors were not reduced in many parts of developing countries [6, 25]. Therefore, this study is designed to identify major factors that can determine occupational injuries among building construction employees in Robe town, southeastern Ethiopia.

2. MATERIALS AND METHODS

An institutional based cross-sectional study design was carried out from March 01-25/2017 in Robe town. Robe is the capital city of Bale Zone which found at a distance of 430 and 180 Kilometers from Addis Ababa and Shashemene cities respectively. The town has four kebeles and thirteen building construction companies with a total of 3,979 employees during the study time.

The sample size was calculated by using a single population proportion formula. Where, P= proportion of occupational injury 38.7% [13], d= 5%, Z=1.96, and 10% of non-response rate:

$n= (Z \alpha /2)^2 * P (1-P) /d^2 = (1.96)^2 * 0.387 (1-0.387)/ (0.05)^2$

$n= 365$

$N= 365 + 10\% = 401.5 \approx 402$

A standardized questionnaire was modified by reviewing different literatures based on the study objectives [20,21,25]. Detailed information about the socio-demographic characteristics, behavioral characteristics, working environment, work history, personal history, psychological questions, awareness and practice towards safety and health in the work place among construction employees, and occurrences of injuries in the previous one year were collected. All the thirteen building construction industries found in the town were included in the study. First, the sample was proportionally allocated to each construction industries then simple random sampling technique was employed to select the required sample from the construction sites. We used the employees' payroll as a sampling frame to pick the study participants using lottery method.

Data quality was assured with translation and retranslation of tools, training of data collectors and supervisors, and pre-test of the questionnaire. Five BSc nurses and two environmental health professionals who can speak Amharic and Afaan Oromo languages were elected for data collectors and supervisors respectively. Then data collectors and supervisors were trained for two days about the questionnaire and how to administer it. The questionnaire was pre-tested on 5% of the sample before the actual data collection to check consistency; correction was taken by identifying potential problem areas. Then face to face interview was conducted by trained data collectors when obtaining informed consent. After completing each interview data collectors checked completeness of the questionnaire. During data collection, the supervisors managed for its completeness on daily basis and feedback was given to each data collectors.

The data was entered to EPI data 3.1 and exported to SPSS version 20 statistical package for analysis. Frequency distribution, mean and percentage calculations were made to describe socio-demographic characteristics and to determine the magnitude of occupational injuries. Logistic regression analysis was also made to see the relative effects of independent variables on the dependent variable. To avoid confounding

factors bivariate followed by multivariate logistic regressions analysis with 95% confidence interval (CI) was applied. First, crude odds ratios (CORs) and 95% confidence intervals (CIs) of each factor were done by using bivariate logistic regression. Variables with P-value less than 0.25 in the bivariate analysis were selected for multivariate analysis. Finally, all variables $p < 0.05$ in multivariate analysis were taken as significance.

3. RESULTS

3.1 Socio-demographic characteristics

From the total sample size of 402 workers to be studied, 4 questioners were incomplete that made the response rate of 99%. Over three-fourths, 76.9% were male. The majority, 77.9% of the participants were in the age group of 18−35 years. Regarding religion, 41.2% identified themselves as Christians. The majority, 70.6% were married. Concerning educational level, 58% of respondents attended primary education. Around eighty percent of respondents had monthly payment of 50 - 150 USD (Table 1).

Table 1: Socio-demographic characteristics of respondents

Variables	Frequency (%) (n = 398)
Sex	
Male	306 (76.9)
Female	92 (23.1)
Age (in years)	
< 18	10 (2.5)
18-35	310 (77.9)
>35	78 (19.8)
Marital status	
Married	281(70.6)
Single	107 (26.9)
Divorce/ Widow	10 (2.5)
Religion	
Christian	164 (41.2)
Muslim	225(35.8)
Others	9 (2.3)
Educational level	
Illiterate	78 (19.8)
Primary(1-8)	231 (58)
Secondary and above	89 (22.2)
Monthly Salary (in USD)	
50-150	318 (79.9)
>150	80 (20.1)

3.2 Workplace and behavioral characteristics

Three-fourths, 74.9% of the employees were temporary workers. One-fourths, 25.6% of the workers was involved on Masonry work category. The majority, 71.9% of the workers had worked above 8hrs per day. Regarding vocational training, 83.7% of the employees didn't attend any kind of workplace health and safety training. Above half, 52.8% of the employees served for <= 2 years. The majority, 79.4% of the workers revealed that work place supervision had never been made in the past 12 months. More than eighty five percent of the workers hadn't used personal protective equipment during the work. The majority, 70.4%, 76.6%, and 83.7% of participants didn't chew chat, drink alcohol and smoke cigarette respectively (Table 2).

Table 2: Workplace and behavioral characteristics of respondents

Variables	Frequency (%) (n = 398)
Employment pattern	
Permanent	100 (25.1)
Temporary	298 (74.9)
Job category	
Excavations	74 (18.6)
Masonry	102 (25.6)
Welder/electrician	46 (11.6)
Plasterers	87 (21.8)
Carpenters	59 (14.8)
Machine Operators	19 (4.8)
Painters	11 (2.8)
Work experience	
<= 2year	210 (52.8)
> 2 years	188 (47.2)
Work hours per day	
=<8 hours	112 (28.1)
>8 hours	286 (71.9)
Health and safety training	
Yes	65 (16.3)
No	333 (83.7)
Use PPE during work	
Yes	57 (14.3)
No	341 (85.7)
Workplace supervision	

Yes	82 (20.6)
No	316 (79.4)
Chew khat	
Yes	118 (29.6)
No	280 (70.4)
Drink alcohol	
Yes	93 (23.4)
No	305 (76.6)
Smoke cigarette	
Yes	65 (16.3)
No	333 (83.7)
Job satisfaction	
Yes	102 (25.6)
No	296 (74.4)
Lack of sleep	
Yes	144 (36.2)
No	254 (63.8)

Regarding the day of injury, on Monday 24.7% of the employees was injured followed by Friday 17.3% while the majority of the employees 31.9% didn't remind the exact day of injury (Figure 1).

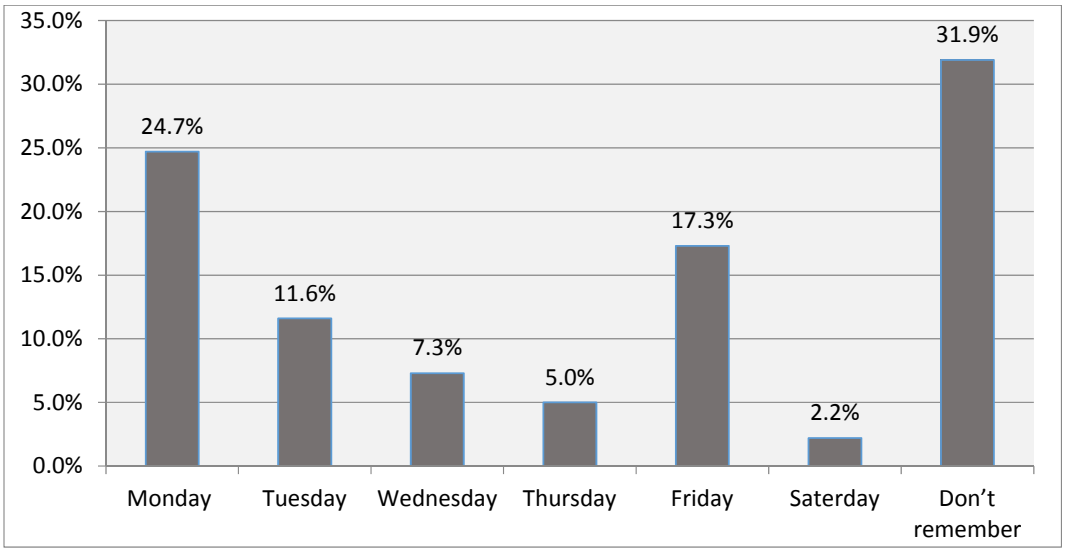

Fig 1: Representing day of the week when injury happened among building construction employees

3.3 Prevalence of occupational injury

The overall prevalence of injury among building construction employees was reported to 39.2% [95 % CI: (34.4, 44.2)] in the previous one year. From which 37.8% of workers sustained more than one injury. The three leading causes of injuries were fall from the same level, 38.5% followed by injuries caused by movable or falling objects, 23.1% and fall from elevation 11.5% (Table 3).

Table 3: Distribution and causes occupational injury among building construction employees

Variables	Frequency (%)
Occupational injuries in the last 12 months (n=398)	
Yes	156 (39.2)
No	242 (60.8)
Number of occurrence (n=156)	
Once	97 (62.2)
More than once	59 (37.8)
***Cause of injury (n=156)**	
Falling from the same level	60 (38.5)
Hurt by movable or falling object	36 (23.1)
Falling from height	21 (13.4)
Injure by sharp instrument	14 (9.0)
Splinting or splashing objects	12 (7.7)
Lifting heavy objects	15 (9.6)
Fire	4 (2.6)
Electric	9 (5.8)
Others	2 (1.3)

**Multiple responses allowed*

In this study, the main types of injuries reported were abrasions, 33.3% cut, 23.7% and fracture, 18.6%. Most work-related injuries happened on hands of the study participants, 26.9% followed by fingers and legs, 23.1%, 17.9% respectively. Around eleven percent of participants had multiple injuries (Table 4).

Table 4: Types of injury and affected body parts among building construction employees

Variables	Frequency (%)
***Types of Injury (n=156)**	
Laceration / Abrasion	52 (33.3)
Cut	37 (23.7)
Suffocation	3 (1.9)
Fracture	29 (18.6)
Dislocation	12 (7.7)
Burn	7 (4.5)
Ear injury	1(0.6)

Electrocutions	4 (2.6)
Eye injury	14 (9.0)
Poisoning	3 (1.9)
Multiple	7 (4.5)
Others	1 (0.6)
*Parts of the body affected (n=156)	
Head	24 (15.4)
Finger	36 (23.1)
Toe	19 (12.2)
Eye	26 (16.7)
Hand	42 (26.9)
Leg	28 (17.9)
Multiple	17 (10.9)
Others	3 (1.9)

Multiple responses allowed

Among the total injured employees, 42.3% were hospitalized, of which 59.5% were hospitalized for more than 24 hours. Around 36.5% of them were absent from their work for more than 3 days (Table 5).

Table 5: Severity of occupational injury among building construction employees

Variables	Frequency (%)
Hospitalized (n=156)	
Yes	37 (23.7)
No	119 (76.3)
Days of hospitalization	
≤24 hours	15 (40.5)
>24 hours	22 (59.5)
Days of absent from work	
≤3 days	99 (63.5)
>3 days	57 (36.5)

3.4 Determinants of occupational injury

In this study the independent variables of injury on the multivariable analysis contains sex of the employee [AOR: 0.396, 95 % CI: (0.137-0.661)], using PPE during work [AOR: 3.615, 95 % CI: (1.153-6.337)], workplace supervision [AOR: 2.072, 95 % CI: (1.561-4.946)], health and safety training [AOR: 5.078, 95 % CI: (2.818-9.148)], and job satisfaction[AOR: 1.912, 95 % CI: (1.171-3.096)]. These explanatory variables remained statistically significant after controlling the confounders (table 6).

Table 6: Determinants of occupational injury, using multivariable logistic regression model

Variables	Injury status		OR(95% C.I)	
	Yes	No	COR, (95% C.I)	AOR, (95% C.I)
Sex of employee				
Male	141	165	1	1
Female	15	77	0.358(0.118-0.792)	0.396(0.137-0.661)
Using PPE during work				
Yes	12	45	1	1
No	144	197	4.586(2.107-9.980)	3.615(1.153-6.337)
Health and safety training				
Yes	16	49	1	1
No	140	193	4.735(2.718-8.249)	5.078(2.818-9.148)
Workplace supervision				
Yes	20	62	1	1
No	136	180	2.108(1.002-4.356)	2.072(1.561-4.946)
Job satisfaction				
Yes	13	89	1	1
No	143	153	1.758(1.224-4.961)	1.912(1.171-3.096)

AOR: Adjusted for age, marital status, work experience, monthly salary, educational level, work hours per day, smoke cigarette, drink alcohol, chew khat, lack of sleep, employment pattern and work category

4. DISCUSSION

The study result revealed that out of the total participants, 39.2% [95 % CI: (34.4, 44.2)] of employees experienced occupational injuries at least once in the past 12 months. This finding is in line with a study conducted in Ethiopia, in Gondar town 38.7 % [13] and Addis Ababa 38.3 % [9]. However, recently higher prevalence was reported from Addis Ababa 84.7% [3]. Our study significantly higher than that of studies done from Egypt (18.4 %) [15], India (22.9 %) [9] and China 15.0% [22]. This inconsistency in the prevalence of injuries could be due to the difference between the two countries in level of development, availability of occupational health and safety facilities, workplace and working conditions, employees' level of awareness to hazard control and prevention, and data collection technique.

This study showed that, falling from the same level (38.5%) followed by hurt via movable or falling object (23.1%) and falling from height (13.4%) were the three leading causes of occupational injuries. This result is almost similar with the study done in northern Ethiopia, fall from ground level, and fall from height were the leading causes of injuries [13]. In Egypt accidents related to falling at ground level, struck by an object and hit by falling objects were major causes of lethal and disabling injuries among building construction employees, [15].

Abrasions, 33.3% cut, 23.7% and fracture, 18.6% were the main types of injuries reported among construction workers. Most occupational injuries happened on hands of the study participants, followed by

fingers and legs, 26.9%, 23.1%, 17.9% respectively. These body parts are the liveliest and openly bare to working equipment and unprotected machines. The hands also support and balance our body during fall accident. These findings were also agree with a study conducted in Addis Ababa [3,10].

This study revealed that male workers have been experienced higher proportion of injuries than females. The odds of injury among females working in the construction job were 60% less compared to males [AOR: 0.396, 95% CI: (0.137-0.661)]. It was comparable with findings conducted in different regions [3, 11, 16]. This difference in chance of getting work-related injury between the sexes of employees might be linked with several factors which can increase the risk of injury such as the difference in task allocated (usually males do harder tasks); work environment (males do the risky job than females specially in the construction site such as work at height), work organization (males relatively worked longer hours per day) etc. [17].

Use of PPE showed statistically significant association with work related injury; construction workers who didn't use PPE during work were 3.6 times more likely to face injury compared to their counter parts. In this study 85.7% of the employees did not use PPE in the course of work. This may indicate that there was absence of provision of PPE from the responsible bodies, or lack of awareness about its significance and carelessness of the employees, [9, 22, 25]. In Iran carelessness of workers and the lack of using protective tools in more than 90% of cases caused fracture, [22] . Seven in ten construction employers felt that the worker being careless was the main cause of work-related injury. Over two thirds (69%) of construction employers felt that the main cause of occupational injury was the employee being careless, [19].

Different studies conducted in developing countries discovered that increased educational level has been inversely related with occupational injuries. Education is more likely to increase employee's safety and health by avoiding them from injuries, [18]. However, this study showed that educational level of employee didn't indicate any statistical significant association with existence of injury. This is because enhancing the educational level of workers by itself alone can't decrease injury, but we should sustained good work administrations, to limit level of exposure according to the standards, applying health and safety rules and procedures, by giving value for safety first [2, 22]. Researches showed that there is a strong association between training on health and safety issues and occupational injury rates among employees. Because health and safety training could inspire workers to be safer and instruct them in right safety conducts. This study indicated that employees who did not train on health and safety were 5 times more likely to report work-related accidents than workers who acquired training [(AOR 5.078, 95% CI (2.818-9.148)]. This result was agreed with studies done in Ethiopia [1,13,8]. In China occurrence of injury among workers didn't engage health and safety training was 16.2 % [22]. This finding indicates the importance of provision of training in prevention and control of occupational hazards and accidents. Injury prevention and safety training should contain basic construction safety, machine operation safety, high working place safety, and chemical safety [25]. According to the health and safety training requirements released in 2006 through the state administration of work safety, construction employees are necessary to obtain at least 32 hours of vocational training before they first pledge to work in construction company and at least 8 hours of safety training yearly and later [23-25]. The health and safety training is usually organized by the construction industry and directed by a licensed safety and health expert. Construction site is not static place of work, where a number of firms are present at the same time to perform work for short periods. Averagely, trained employees were present at construction sites for 10 months, although a systematic training program could have a better effect if measured in the long term [13,24].

Regular workplace supervision also reduced injury by 2.072 times more likely [AOR: 2.072, 95% CI: (1.561-4.946)]. It was agree with different findings, [5,14, 15]. In Iran lack of supervision was identified as leading cause of work related injury, it caused 80% of deaths and 71% of amputation, [26]. Therefore, the employer must ensure that employees are properly instructed and supervised the healthy operation of any machinery, tools, equipment, process, or practice that they are approved to use and act in a safe and healthful manner, and conduct their work in compliance with all applicable safety and health rules, [19].

Another essential finding of this study was that the odds of injuries among workers who didn't satisfied with their job were 1.9 times more likely injured compared to their counterparts, [AOR=1.912, 95% CI (1.171-6.096)]. An increasing number of studies have reflected job satisfaction as prevalent and powerful factor in the occurrence of occupational injuries in the work environment [2,13, 14]. Job dissatisfaction may be related with work environment, Leadership style, motivation and incentives, like working for long hours without enough rest, low payment, working in hazardous job, unable to get health and safety services and so on. Therefore, these conditions may affect the employees to lose their work behavior and concentration. This is due to the fact that when the employees don't satisfied with their job, they couldn't experience meaningfulness, greater responsibility, and better use of their knowledge and skills in their job and such situation leads to declined safety in their work and increased occupational injuries. In Egypt 51.2% of the disabling injuries were caused by human factors like lack of attention, [15]. Basically, when job satisfaction is increased, on- task activities are improved, leading to greater attention to safety motivation, knowledge, and compliance. Thus, increasing employee job satisfaction could be as important as eliminating occupational hazards in the workplace [9].

5. LIMITATION OF THE STUDY

This study has the following limitations. A cross-sectional study design could result in recall bias under or over report of injury events, especially if they were minor injuries, as the data was found based on self-reported practices rather than direct observation. In addition, some of the employees weren't willing to tell the entire occupational problems due to fear of job insecurity following discharging the information and employees who were injured and on permission during the data collection time may underrate any association.

6. CONCLUSION

In this study a relatively higher occurrence of injury was described among construction workers compared to other studies. Factors such as sex of the workers, employees working without using PPE, absence of health and safety trainings, lack of regular supervision and job dissatisfaction were associated with significantly higher levels of occupational injury among construction workers. Therefore, the employer should focus on areas, such as provision of safety trainings, promoting use of PPE during work, plan regular workplace supervision, and satisfy their employees by creating good work environment and working situation to mitigate the burden of occupational injuries.

CONSENT

As per international standard or university standard, Informed consent was obtained from each interviewee and they were also given the choice to refuse to participate in the study.

ETHICAL APPROVAL

As per international standard or university standard, Ethical clearance letter has been obtained from Madda Walabu University ethical clearance committee. Support letter was taken for construction industries responsible persons and other concerned bodies in Oromia region, Robe town.

AVAILABILITY OF SUPPORTING DATA

Data will be available upon request.

COMPETING INTERESTS

The authors have no any competing interest.

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This study was funded by Madda Walabu University, Ethiopia.

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