

## Magnitude of Occupational Injuries and Associated Factors among Small-Scale Industry Workers in Mekelle City, Northern Ethiopia

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### Abstract

**Background:** Occupational injuries are important public health problems that comprise a major part of injury burden in Ethiopia. The present study investigates the magnitude and associated factors with occupational injuries among small-scale industry workers in Mekelle city, Northern Ethiopia in 2013.

**Methods:** A cross-sectional study was conducted on 774 small-scale industry workers from March to April 2013. Multi-stage sampling technique was used to select the study participant's. A pre-tested and structured questionnaire was used to obtain information on the occurrence of occupational injuries and allied factors. Data was analyzed using STATA software version 12. Bi-variate and multivariate analysis was carried out to ascertain the association between dependent and independent variables.

**Results:** A total of 758 (97.9%) small-scale industry workers were interviewed. A one-year prevalence rate of at least one occupational injury among the small-scale industry workers was 58.2%. Use of personal protective equipments [AOR=3.43, 95%CI: 2.39-4.94], age of respondent's [AOR=1.51, 95%CI: 1.02 - 2.25], number of years worked in the same job [AOR=2.89, 95%CI: 1.88-4.43], number of hours worked per week [AOR=2.73, 95%CI: 1.92-3.87], and the job category; metalworkers [AOR=3.17, 95%CI: 2.07-4.85] and wood workers [AOR=2.34, 95%CI: 1.39-3.92] were found to be significantly associated factors with occupational injury among small-scale industry workers.

**Conclusion:** This study concludes that the prevalence of occupational injuries among small-scale industry workers was considerably high. Hence, promoting occupational safety and health through appropriate prevention programs and provision of comprehensive occupational health and safety services with the provisions of personal protective devices, and focused interventions for young, less experienced, workers who work for extended hours (>48 hours per week) and workers working on metal and wood works are highly advised.

**Keywords:** Occupational injury; Magnitude; Associated factors; Small scale industry workers; Mekelle Ethiopia

### Introduction

Occupational injuries are important public health problems that comprise major part of the injury burden in small-scale industries (SSIs) [1]. SSIs particularly woodworking, metalworking and concrete block manufacturing industries are among the highest ranked small-scale industries in terms of risks for occupational injuries [2,3].

The prevalence rates of occupational injuries among the SSIs differ by the branches of the economic sectors, regions and countries [4]. In SSIs of different countries found out different prevalence of occupational injuries including Norway 31.70% [5], in Yashio city, Japan 44.20% [2], and in India 49.70% [6]. A study in Ghana stated that the prevalence of occupational injuries among workers was 40% and this rate was indicated to be up to 10 times higher than reported rates in developed countries. However, the study also depicted that the employers and workers were not taking actions because of lack of relevant knowledge and funds [7]. In Ethiopia, SSIs are playing an ever-increasing role in the industrial structure of the country, which stimulate other sectors of the economy such as trade, construction and services and reduce unemployment. According to the Central Statistical Agency (CSA), a total of 138,954 individuals (90% male, 84% literate) were engaged in small-scale manufacturing industries in the country in 2008 [8].

A study in North Gondar Ethiopia reported that one-year prevalence of occupational injuries among SSI workers was 35.50% [9]. Findings of different studies pointed out the most frequently injured body parts were upper and lower limbs [4,9,10].

Literatures from different countries, identified various factors contributing to occupational injury; which include male sex [11], lack of formal education (compared to literate), smoking status [12,13], sleeping problems [9,14], not doing sporting activity (physical exercise) [15], frequent alcohol consumption [12,13,16], extended work hours (working for more than 48 hours/week) [9,12,17], absence of health and safety training/education [18], non-day timework (working during nighttime) [17], working physically very exhausting tasks (high physical demand) [19], being a metal and wood worker [2], job experience (duration) [9,17], not using personal protective equipments (PPEs) [5,20], workers' job dissatisfaction [18] and presence of health problems [12,13,21] were found to be significantly associated factors with occupational injury.

However, the discrepancies in relation to the occurrences of occupational injuries among SSI workers appear to necessitate further investigations. In Ethiopia, information regarding occupational

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injuries in SSIs is rare, and very limited attempts have been made to investigate the magnitude and associated factors [9,22]. The basis for this study was to address the information gaps about the magnitude and associated factors with occupational injuries that could help in designing appropriate prevention and control measures.

## Methods

### Study design and setting

This study was conducted among selected small-scale industry workers using facility based cross sectional study design, from March to April, 2013 in Mekelle, a city in northern Ethiopia and the capital of Tigray regional state.

### Study population and sampling techniques

The study subjects were all sampled small scale industry workers from the selected small-scale industries in Mekelle city. Sample size was determined using single population proportion formula, with prevalence estimates of 35.5% [9], considering 5% margin of error, 95% confidence level. Then multiplying by a design effect of 2 and adding a 10% contingency for the non-response rate, the total sample size was calculated to be 774.

A multi-stage sampling technique was used to select the sample among SSI workers.

Initially, the 893 SSIs were stratified into three strata based on the type of the SSI and the product the industries manufacture. The three strata consisted of 527 Metal-works, 170 wood-works and 196 concrete-block manufacturing SSIs. Using the list of all SSIs as a sampling frame; 268 (30%) SSIs located in the 7 sub cities of the study area were selected using systematic random sampling (SRS) with a sampling interval of 3 for the SSIs. Based on probability proportion to size (PPS) of the number of SSIs in each stratum we got 158 metal-works, 51 wood-works and 59 concrete-block manufacturing SSIs.

Finally, 774 sample of SSI workers were taken using simple random sampling based on PPS of the number of workers employed in each SSI (taking 2 respondents from SSIs employing <5 workers and 4 respondents from SSI employing 6-9 workers) getting 462 metal workers, 146 wood workers, and 166 block manufacturing workers recruited for the study (Figure 1).

### Data collection technique and data quality control

Data were collected using a structured face to face interview questionnaire and observational checklist. The tools were adapted and developed after reviewing the standard occupational health and safety guidelines and other relevant literatures in reference to the research question [5,8,9,23-26]. The variables were checked for clarity and translated into the local language of Tigrigna and then back translated into English to check consistency of thoughts of the questions.

Six (6) experienced data collectors and one supervisor were hired to collect the data and training on the content, objective and methods of data collection and interviewing technique was given to data collectors and supervisors.

During the data collection, regular supportive supervision and discussion with data collectors and supervisors was being done at the spot by the investigator to monitor the data collection process. One week prior to the actual data collection period, pretest was conducted on 40 workers in similar SSIs and set ups and relevant modifications were made to it accordingly.

To support the self-reported information, the principal investigator also did the walkthrough survey using observation checklist.

### Data management and analysis

The collected data was entered and cleaned in Microsoft excel sheet and then it was exported to STATA software Version 12 for analysis. Descriptive analysis of the variables was conducted using frequencies and percentages by making all variables categorical.

Regarding to the association between determinants and occupational injury, a bivariate logistic regression analysis was done making the dependent variable occupational injury with two categories (occupational injury: No=0, Yes=1). In the bivariate logistic regression, the variables with P-value<0.05 level of significance were entered to multivariate logistic regression.

In the multivariable logistic regression analysis, stepwise regression method was used to develop the model for the dependent variable occupational injury. The presence of significant interaction terms, and confounding effects were checked using Log likelihood ratio test at P-value<0.05 level of significance and if a variable's inclusion in the model alters the estimated regression coefficient for the other variable by >15%. Log likelihood ratio test at P-value<0.05 level of significance was used to decide inclusion of a variable in to the model and the goodness of fit of the final model was checked using Hosmer Lemeshow test of goodness of fit considering good fit at P-value>0.05.

### Ethical consideration

Ethical clearance was obtained from Mekelle University, College of Health Sciences, Research and Community service office. Official permission letter was secured from Mekelle city trade and industry office.

Prior to the interview and walkthrough survey the owners of the SSIs were informed and communicated about the purpose of the study and permission was sought from them for data collection activities. Data collection was then conducted after explaining the aim of the study and its possible benefits to the study participants. Verbal and written consent was obtained after explaining their full right to refuse, withdraw any time, without any explaining or giving reasons and without repercussions.

The right of participants to anonymity and confidentiality was ensured by making the questionnaire anonymous and the data was secured and would not be used for other purposes.

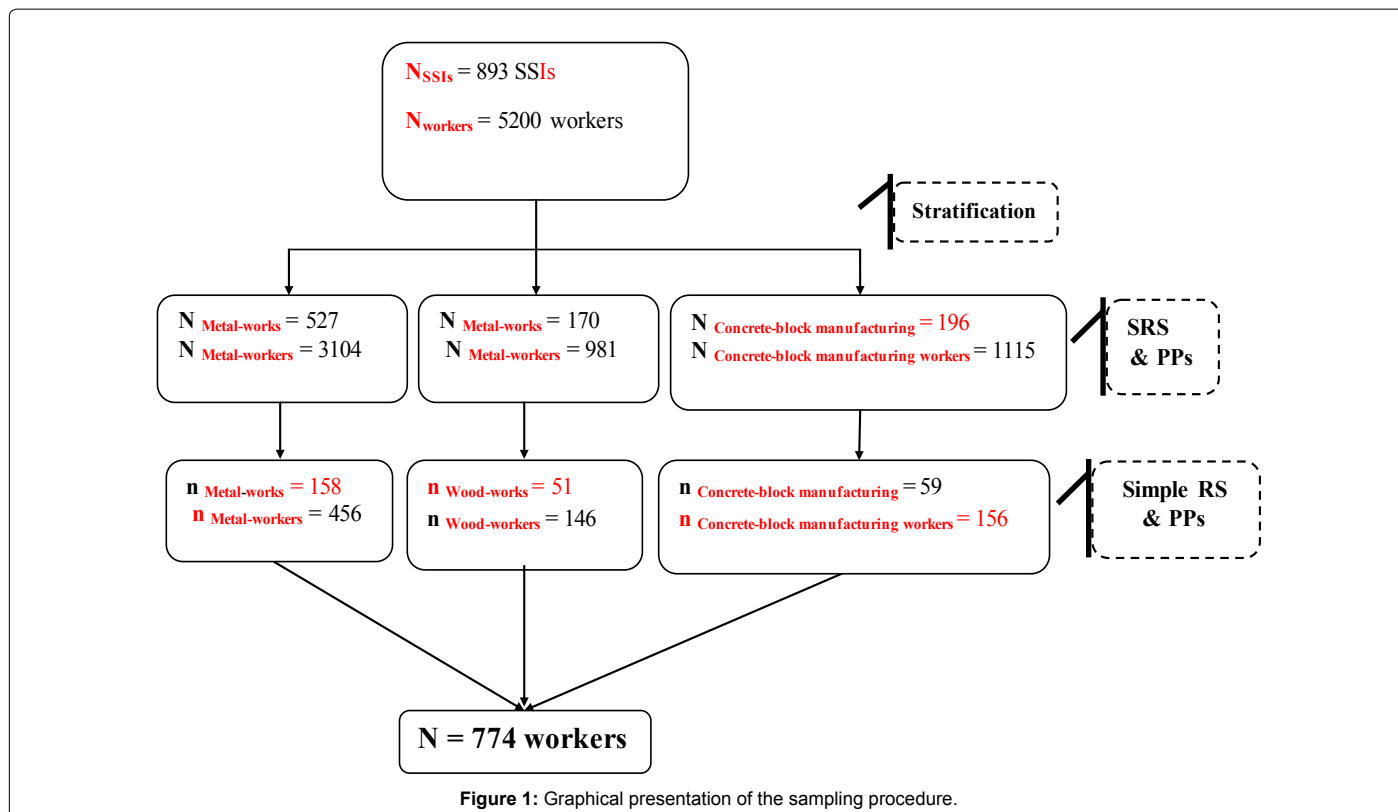
## Results

### Socio-demographic and lifestyle characteristics of the respondents

A total of 758 SSI workers were interviewed, with a response rate of 97.9%. Male and female respondents were 736 (97.1%) and 22 (2.9%) respectively. Educational status of the respondents showed that (5.2%) were illiterate and (94.8%) were literate. The present study also showed, cigarette smokers were 64 (8.4%) and frequent alcoholic drink consumers were 37 (4.9%) in SSIs (Table 1).

### Occupational characteristics of the respondents

The respondents worked in the same job for ≤5years were 601 (79.3%) and 157 (20.7%) of the respondents worked for >5years. The respondents used PPEs properly and consistently were 256 (33.8%). Only 99 (13.1%) of the respondents got occupational safety and health



training within the last 12 months. Workers job category showed that 156 (20.6%) were block manufacturing workers, 456 (60.2%) were metalworkers, and 146 (19.3%) were wood workers (Table 2).

### Magnitude and characteristics of the occupational injuries

The one-year prevalence rate of at least one occupational injury in the last 12 months among the SSIs was 58.2%. The 441 respondents were injured including injury on their upper limbs 218 (49.4%), lower limbs 91 (20.6%), and on their neck or head parts 59 (13.4%). The respondents suffered from mild and severe injury were 307 (69.6%) and 134 (30.4%) respectively (Table 3).

### Predictors of occupational injuries

The multivariable logistic regression analysis result revealed that use of PPEs, age of respondent's, number of years worked in the same job, number of hours worked per week, and the job category were found to be significantly associated factors with occupational injury among SSIs workers.

The respondents who did not use PPEs properly and consistently were 3.43 times [AOR=3.43, 95%CI: 2.39-4.94] more likely to sustain occupational injury than respondents who used PPEs properly and consistently. The respondents who worked for 5 or less years in the same job were 2.89 times [AOR=2.89, 95%CI: 1.88-4.43] more likely to experience occupational injury than respondents who worked for more than 5 years in the same job. The respondents who worked for more than 48 hours a week were 2.73 times [AOR=2.73, 95%CI: 1.92-3.87] more likely to experience occupational injury than respondents who worked for 48 or less hours a week.

Metalworkers were 3.17 times [AOR=3.17, 95%CI: 2.07-4.85] and wood workers were 2.34 times [AOR=2.34, 95%CI: 1.39-3.92] more

likely to experience occupational injury than block manufacturing workers (Table 4).

### Discussions

The present cross-sectional study attempted to investigate the magnitude and factors associated with occupational injury among SSI workers in Mekelle city, 2013.

The respondents were predominantly young, male adults with <5 years of workplace experience. Majority (97.10%) of the respondents in this study were males. This may be attributed to the high level of physical manual labor in the SSIs. This study showed that one-year prevalence rate of occupational injury among the SSI workers was 58.2%. This finding was relatively higher than the studies conducted in North Gondar Ethiopia [9], Ghana [7], India [6], and Japan [2]. These differences in the prevalence rate of occupational injury could presumably be due to the differences in socio-economic levels of workforce, lack of safety training and awareness; and limited occupational safety and health services and practices [2,3,18].

The study revealed that most of the occupational injuries sustained by respondents were on the upper and lower limbs, and this finding was consistent with findings from Brazil, North Gondar Ethiopia and India [4,9,10].

The multivariable logistic regression analysis indicated that use of PPEs, age, and number of years worked in similar job, number of hours worked per week, and respondent's job category were the significantly associated factors with occupational injury among SSIs workers.

The respondents who didn't use PPEs had about 3 times more likely to experiencing occupational injury than respondents who used PPEs; and this could possibly be due to lack of extra protection from

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	736	97.1
	Female	22	2.9
Age	<30 Years	607	80.1
	≥30Years	151	19.9
Educational status	Illiterate	39	5.2
	Literate	719	94.8
Monthly Salary	<700 ETB	158	20.8
	≥700 ETB	600	79.2
Marital status	Married	202	26.6
	Unmarried	556	73.4
Frequent alcoholic drink consumption	Yes	37	4.9
	No	721	95.1
Smoking status	Yes	64	8.4
	No	694	91.6
Sleeping problems	Yes	69	9.1
	No	689	90.9
Health problem/illness	Yes	46	6.1
	No	712	93.9
Doing regular sporting activity (physical exercise)	Yes	315	41.6
	No	443	58.4

**Table 1:** Socio-demographic and lifestyle characteristic of small-scale industry workers in Mekelle City, Tigray region, North Ethiopia, 2013 (n=758).

Variable	Category	Frequency (n)	Percentage (%)
Number of years worked in same job	≤5 Yrs	601	79.3
	>5 Yrs	157	20.7
Personal protective equipments use	Yes	256	33.8
	No	502	66.2
Overall job dissatisfaction	Yes	187	24.7
	No	571	75.3
Got safety and health training	Yes	99	13.1
	No	659	86.9
Number of hours worked/ week	≤48 hrs	433	57.1
	>48 hrs	325	42.9
High time pressure	Yes	499	65.8
	No	259	34.2
Work at night time	Yes	269	35.5
	No	489	64.5
Work physically very exhausting tasks	Yes	478	63.1
	No	280	36.9
Workers job category	Metal workers	456	60.2
	Wood workers	146	19.3
	Block manufacturing workers	156	20.6

**Table 2:** Occupational characteristics of small-scale Industry Workers in Mekelle City, Tigray Region, North Ethiopia, 2013 (n=758).

such equipments despite the equivalent exposure of the respondents to occupational hazards. This finding was consistent with findings of other similar studies [5,18,20].

The respondents who worked for <5 years in the same job had about 3 times more likely to experiencing occupational injury. This could be probably, independent of age, be due to their limited knowledge and skills on machines and tools in use, inadequate understanding of occupational hazards, and lack of experience on the job. This finding was consistent with findings of other studies [9,17]. The respondents

who worked for >48 hours a week had about 3 times more likely to sustaining occupational injury. This could presumably be due to the excessive tiredness connected to such relatively long work hours. This finding was consistent with findings of other similar studies [9,12,17,25]. In addition to that it is predictable that when they work more than 48h, the number of occupational injuries be higher.

In relation to workers job category, metalworkers had about 3 times and wood workers had about 2 times more likely to experiencing occupational injury than block manufacturing workers. This might be due to their involvement in operating heavier machineries, differences in the task and workplace hazards. This finding was consistent with findings of other similar studies [2].

However, respondent's sex and working during nighttime were not significantly associated factors. Moreover, not getting occupational safety and health training/education in the last 12 months was not a significantly associated factor with occupational injury in this study. This could probably be due to ineffectiveness of the services coupled with high level of hazards, limited use of reliable techniques and safe work organizations.

### Strength of the study

The data was primary data, and was collected through face-to-face interviews and the sample size was made to rise considerably to increase the representativeness of the sample to the source population. The present study acts as baseline information to government and non-governmental bodies for further research and interventions.

### Limitations of the study

The investigation is based on self-reported data elicited through interviews, which could be subject to recall bias of 12 months recall period. The absenteeism of injured workers from workplaces and healthy-worker effect may underestimate injury rates. The cross-sectional nature of the study design limits an interpretation of clear causal relation between the associated factors and the occupational injuries in this study.

### Conclusions and Recommendations

The study concludes that the prevalence of occupational injuries among SSIs workers was relatively high. The most frequently injured body parts were upper and lower limbs. The study has identified specific groups of workers as having a greater risk of experiencing

Variable	Category	Frequency (n)	Percent (%)
Occupational injury	Yes	441	58.2
	No	317	41.8
Body parts injured	Upper limb	218	49.4
	Lower limb	91	20.6
	Neck or head part	59	13.4
	Many parts concurrently	53	12.0
	Abdomen, trunk, other	20	4.6
Relative severity of injuries	Mild	307	69.6
	Severe	134	30.4
Frequency of injuries	Once	297	67.4
	More than once	144	32.6
Absenteeism from work due to injury	≤3 days	279	63.3
	>3 days	162	36.7

**Table 3:** Magnitude and characteristics of the occupational injuries among Small-scale Industry Workers in Mekelle City, Tigray Region, North Ethiopia, 2013 (n=758).



Associated factor	Category	COR (95% CI)	AOR (95% CI)
<b>Sex</b>	Female <sup>@</sup>	1.00	
	Male	2.50 (1.04-6.04)*	-
<b>Age</b>	≥30Years <sup>@</sup>	1.00	1.00
	<30 Years	2.33(1.67-3.27)**	1.51(1.02-2.25)
<b>Years worked in similar job</b>	>5 Yrs <sup>@</sup>	1.00	1.00
	≤ 5 Yrs	2.99(2.08-4.32)**	2.89 (1.89-4.43)
<b>PPE use</b>	Yes <sup>@</sup>	1.00	1.00
	No	3.96(2.88-5.44)**	3.43(2.39-4.94)
<b>Occupational health safety training</b>	Yes <sup>@</sup>	1.00	-
	No	2.41(1.56-3.71)**	
<b>Work hours per week</b>	≤48 hrs/wk <sup>@</sup>	1.00	1.00
	>48 hrs/wk	3.61(2.64-4.94)**	2.73(1.92-3.87)
<b>Work at night time</b>	No <sup>@</sup>	1.00	-
	Yes	1.41(1.04-1.92)*	
<b>Workers job category</b>	Block manufacturing workers <sup>@</sup>	1.00	1.00
	Wood-workers	2.20(1.39-3.49)**	2.34(1.39-3.92)
	Metal-workers	2.08(1.44-3.01)**	3.17(2.07-4.85)

<sup>@</sup>Reference group, \*Significant at p-value ≤ 0.05, \*\*Significant at p-value ≤ 0.01, Rf: Reference group; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval.

**Table 4:** Predictors of occupational injuries among Small-scale Industry Workers in Mekelle City, Tigray Region, North Ethiopia, 2013 (n=758).

injuries. Consistent with other studies, workers who didn't use PPEs, whose age is less than 30 years, who worked for 5 or less years in the same job, who work for more than 48 hours a week were more likely to experiencing occupational injury than their counter parts. Besides, metal and wood workers were more likely to experiencing occupational injury than block-manufacturing workers were.

Based on the study findings, we recommend promoting occupational safety and health through appropriate prevention programs and provision of comprehensive occupational health and safety services with the provisions of personal protective devices and follow up of their appropriate utilization, ensuring regular workplace inspections with feedbacks mechanism, and focused interventions for young, less experienced, workers who work for extended hours (>48 hours per week) and workers working on metal and wood works. Besides, reviewing the enforcement of regulations of safety standards and laws governing work practices, training on occupational health and safety to all categories of workers and integrating injury prevention by mainstreaming occupational health and Safety procedures in SSIs were highly advised.

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#### Authors Contributions

**AB:** Involved in generating the concept of this research paper, proposal writing, designing, analysis, write-up, and preparation of scientific paper; **DY:** Involved in proposal writing, designing, analysis, write-up, preparation of scientific paper or the manuscript and corresponding author of the manuscript; **AG:** Involved in proposal writing, designing, analysis, write-up and preparation of scientific paper or the manuscript; **WT:** Involved in proposal writing, designing, analysis, write-up and preparation of scientific paper or the manuscript; **LI:** Involved in write-up and manuscript preparation. Finally all the authors have approved the final manuscript.

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