

# Compliance with Standard Occupational Health and Safety Measures and Associated Factors Among Small-Scale Metal Industry Workers in Central Ethiopia

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**Background:** Compliance with workplace health and safety measures can result in considerable reduction in workplace injuries and fatalities and attributed economic costs. However, majority of studies conducted in small-scale industries in numerous countries, including Ethiopia focused on the prevalence of occupational injuries and there is a paucity of evidence on level of employees' adherence to safety measures and the associated factors. Therefore, this study was conducted to assess workers' compliance and factors associated with occupational health and safety practices in small-scale metal industries in Central Ethiopia.

**Methods:** This study was conducted in Central Ethiopia. A total of 415 small-scale metal workers were included in this study. Study participants were selected using a simple random sampling technique. A structured interviewer-administered questionnaire was used to collect the data. The collected data were entered using EPI Info version 7.2 and exported to IBM-SPSS Version 22 for further cleaning and analysis. Bivariate and multivariate Binary Logistic Regression were conducted to determine association and during the multi-variable regression variables with a p-value <0.05 were considered significantly associated factors.

**Results:** The study found a 39.3% (95% CI: 34.7, 44.1) prevalence of good compliance with safety and health measures among small-scale metal workers. Temporary employed workers were less likely to adhere [AOR=0.43, 95% CI (0.21, 0.93)] and workers who received training were more likely to adhere [AOR=5.75, 95% CI (2.56, 12.9)] to safety precautions. Other significantly associated variables included work experience, working at night, and satisfaction with the current salary.

**Conclusion:** This study sheds light on small-scale metal workers' commitment to workplace safety and health procedures, indicating a compliance rate of 39.3%, which is low. Temporary employees and less experienced workers are less likely to follow health and safety precautions. Workplace health and safety training are associated with increased safety precautions.

**Keywords:** safety compliance, health and safety, small-scale industries, metal workers, Ethiopia

## Background

Occupational health and safety refers to the measures, policies, and practices that organizations and employees should adhere to guarantee the health and safety of employees and improve their overall productivity and performance.<sup>1,2</sup> The implementation of simple preventive health and safety measures like using safety manuals and wearing protective gears during working hours can result in a considerable reduction in the loss of human life and economic costs associated with workplace injuries and fatalities.<sup>3</sup>

The International Labor Organization has reported that the annual estimated work-related fatalities and non-fatal injuries are 2.78 million and 374 million, respectively. Furthermore, the estimated global economic loss linked to workplace injuries is approximately 3.9% of global Gross Domestic Product (GDP), with 1473 billion euros and 1207 billion euros lost owing to fatal and non-fatal incidents, respectively.<sup>4,5</sup>

Industrialized nations have long acknowledged the importance of occupational health and safety. Employee compliance with health and safety regulations is a priority for the industries and stakeholders in these countries. However, occupational health and safety are prioritized less in developing countries, and many businesses continue to lack the bare minimum of health and safety protocols, exposing their employees to a wide range of workplace hazards.<sup>6</sup> Small-scale industries are industries that have 10 to 20 workers and mainly utilize hand tools for production. The nature of the work in combination with the poor health and safety management systems and failure to comply with health and safety procedures exposes the employees to hazards.<sup>7,8</sup>

Small-scale metal industries are among the most dangerous jobs in developing countries, with a wide range of occupational hazards responsible for many fatal and nonfatal workplace injuries.<sup>9,10</sup> However, most employees in these businesses did not follow health and safety procedures and Occupational Health and Safety (OHS) adherence remained low. Lack of attention by managers, employee educational status, income, lack of training on health and safety, lack of knowledge on health and safety, negative/poor perception regarding health and safety measures, lack of procedures or regulations, lack of safety materials, and poor supervision/inspection are the main reasons for non-compliance with health and safety measures.<sup>11–13</sup>

Small-scale industries in Ethiopia are among the most dangerous places to work, with an annual prevalence of self-reported occupational injuries ranging from 30% in the Bale Zone to 58.2% in Mekelle City.<sup>14,15</sup> Metal sectors have a greater rate of occupational injuries and majority of employees did not adhere to occupational safety and health standards such as proper use of personal protective equipment.<sup>16–18</sup> The prevalence of PPE use was observed to be 76.2% among small-scale metal workers, with the linked characteristics of educational status, job experience, OHS training, and regulatory availability.<sup>19</sup>

Studies on the incidence of occupational hazards and injuries in small-scale companies conducted in numerous countries, including Ethiopia, have found a high prevalence of injuries and low compliance with OHS measures. But only limited studies had tried to find out those factors influencing adherence to OHS measures. Therefore, determining the level of OHS adherence and the factors influencing it is crucial. Therefore, this study aimed to assess workers' compliance with occupational health and safety practices, as well as associated factors, in small-scale metal industries in Central Ethiopia.

## Methods and Materials

### Study Area

This study was conducted in Central Ethiopia. According to the city administration micro and small enterprise development office, there are more than 72 registered small-scale metal industries which have 5 and more workers within the town and peripheries, with a total of 631 metal workers.

### Study Design and Period

An institutional-based cross-sectional study was conducted from May to July 2023.

### Source and Study Population

Source population: The source population for this study was all small-scale metal industry workers.

Study population: The study population consisted of small-scale metal industry workers randomly selected from any work category.

### Inclusion and Exclusion Criteria

Inclusion criteria: All small-scale metal industry workers who were involved in production activities during the study period were included in the study.

Exclusion criteria: workers aged <18 years and administrative workers those who are not directly involved in any of the production processes were excluded from the study.

## Sample Size Determination and Sampling Technique

### Sample Size Determination for First Objective

The sample size was calculated using the formula for a single population proportion in Epi Info Version 7.2 software.

The following assumptions were considered to calculate the sample size for the first objective:

- The hypothesized proportion of 50% to get the maximum sample size.
- 5% margin of error,
- 95% level of confidence ( $Z=1.96$ )
- 10% response rate

Accordingly, the sample size calculated for the study is 423.

### Sampling Technique and Procedure

Prior to the list of small-scale metal industries, workers were obtained from the city administration's micro and small enterprise development offices, and surveys were conducted for each small-scale metal industry. Then, workers were given a unique identifier, and Microsoft Excel randomizer was applied for the random selection of the total study participants.

## Operational Definition

**Practice towards safety measures:** Respondents were asked 10 questions, each of which asked a five-point Likert scale agreement from "Always" to "Never". Responses of "Always" and "Usually" were considered "Positive responses" and given a value of "1", whereas responses of "Sometimes", "Rarely" and "Never" were considered "Negative responses" and given a value of "0". Practice was considered as "Good" considering a positive response for  $\geq 80\%$  by the respondent.

**Knowledge regarding safety measures:** Respondents were asked 10 knowledge-related questions, and the correct answer was given a value of 1, and for those incorrect answers, a value of 0 was given. Then, the total score was computed by summing up all the items together, and the respondents' scores were categorized into three categories: poor ( $\leq 50\%$ ), fair (51 to 75%), or good knowledge ( $> 75\%$ ).

**Attitude regarding safety measures:** Respondents were asked 10 attitude-related questions using a five-point Likert scale. The respondent score was then computed by summing all the items together, and the respondents' scores were dichotomized as favorable attitudes ( $> \text{mean}$ ) or unfavorable attitudes ( $< \text{mean}$ ).

## Data Collection Instrument and Procedure

### Data Collection Instrument

An interviewer-administered structured questionnaire was prepared by reviewing relevant literature. The questionnaire was prepared in English and translated into the Amharic language. It includes five main parts: participants' socio-demographic characteristics, personal characteristics, information and knowledge characteristics, attitude, and practice-related characteristics ([Additional File 1](#)).

### Data Collection Procedures

Before the data collection period, pre-testing of the questionnaire was conducted on small-scale metal workers in a town near the study area, using 5% (21 respondents) of total sample size, and necessary modifications were made before utilizing on the study participants. Face-to-face interviews were conducted privately, after written consent was obtained from each participant.

The study team consisted of one supervisor (MPH in Environmental Health) and three data collectors (BSc in Environmental Health) who had good experience in data collection and fluency in both Amharic and the local language. Training was provided for half a day (theoretical and field training) at the study site to the supervisor and data collectors prior to data collection.

## Data Quality Control

To ensure the appropriateness and quality of the data collection, interviewers were discussed about half a day about the aim of the study, the contents of the instrument, and how to conduct it before starting data collection. Each day, the completed format was checked by the principal investigator to ensure the completeness and correctness of the data. Finally, the completeness of the questionnaire was checked before the analysis and interpretation.

## Data Analysis

The collected data were coded and entered using the data entry template designed in Epi Info, version 7.2. The data were then cleaned by checking for outliers, inconsistencies, and missing values and analyzed using SPSS version 20 software.

Descriptive data are presented using frequencies, tables, and graphs. Bivariate analysis was conducted to examine various associations using a binary logistic analysis. All variables with a P-value  $<0.2$  during the bivariate analysis were included for further fit to multivariable logistic regressions for better prediction of association. Crude and adjusted odds ratios with 95% confidence intervals was computed to determine the strength of association between the outcome and predictor variables. Statistical significance was set at  $p < 0.05$ .

## Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki, and an ethical clearance approval letter was obtained from the Wachamo University Institutional Review Board. Written Informed Consent was obtained from each study participant before data collection which is approved by Wachamo University Institutional Review Board.

## Result

### Socio-Demographic Characteristics of Respondents

The response rate of the study was 98.1%. Almost all (99.5%) the study participants were male. More than three-fourth (78.2%) of the participants' ages ranged from 21 to 40 years. Majority of the study participants had formal education, with 174(41.9%) and 41(9.9%) having studied secondary school and college diploma/above, respectively. Half (49.6%) of the study participants were single and one-fourth (25.1%) had an income of  $\leq 1500$  Ethiopian birr (Table 1).

### Work Related Characteristics of Respondent

Three-fourth (74.7%) of the study participants were recruited as a professional. Of the study participants, 163(39.3%) had less than 5 years of experience. Two hundred thirty-seven (57.1%) worked more than 40 hours within a week, and almost one-third (31.8%) worked at night (Table 2).

**Table 1** Socio-Demographic Characteristics of Small-Scale Metal Industries Workers in Central Ethiopia, 2023

Variables	Frequency	Percentage
<b>Sex of respondent</b>		
Male	412	99.5
Female	3	0.5
<b>Age (in Years)</b>		
$\leq 20$	59	14.2
21–30	162	39
31–40	164	39.2
$\geq 41$	30	7.2

(Continued)

**Table 1** (Continued).

Variables	Frequency	Percentage
<b>Educational status</b>		
Read and write	74	17.8
Primary	126	30.4
Secondary	174	41.9
College and above	41	9.9
<b>Marital status</b>		
Single	206	49.6
Married	194	46.7
Divorced/Widowed	15	3.6
<b>Monthly income (ETH Birr)</b>		
≤1500	104	25.1
1501–5000	238	57.3
>5000	73	17.6

**Table 2** Work-Related Characteristics of Small-Scale Metal Industries Workers in South Ethiopia, 2022

Variables	Frequency	Percentage
<b>Work title</b>		
Professional	310	74.7
Assistant	105	25.3
<b>Employment status</b>		
Permanent	325	78.3
Temporary	90	21.7
<b>Work experience</b>		
<5 years	163	39.3
5–10 years	177	42.7
>10 years	75	18.5
<b>Work time a week (in hours)</b>		
≤40 hours	178	42.9
>40 hours	237	57.1
<b>Working at Night</b>		
Yes	132	31.8
No	283	68.2

## Personal Habit Related Characteristics of Respondents

Out of the study participants, 164(39.5%) drank alcohol, and 177(42.7%) chewed khat. Only 42(10.2%) smoked cigarettes. Half (50.4) of the study participants had sleeping problems that might make them sleepy during the daytime and unable to sleep at night. Almost half (49.9%) of the respondents were satisfied with their current job and only 59 (14.2%) were satisfied with their current salary (Table 3).

## Training, Knowledge, Attitude and Practice on Work Place Safety and Health

Out of the total 415 study participants, 163(39.3%) showed good compliance with occupational health and safety measures to prevent themselves from work place accidents. Regarding professional training, only 95 (22.9%) had professional training in metal work, and only seventy four (17.8%) had training in work place safety and health. Of the study participants, two hundred seven (49.9%) had fair knowledge of work place safety and health. Half (50.1%) of the study participants had favorable attitudes towards the importance of work place safety and health on employees' health status (Table 4).

## Factors Associated Compliance to Occupational Health and Safety Measures

Factors including employment status, work experience, working at night, satisfaction with salary, and training in metal work were significantly associated with a p-value of <0.05, with compliance to occupational health and safety during the multivariate regression (Table 5).

**Table 3** Personal Habit-Related Characteristics of Small-Scale Metal Industries Workers in Central Ethiopia, 2023

Variables	Frequency	Percentage
<b>Do you drink alcohol</b>		
Yes	164	39.5
No	251	60.5
<b>Do you chew Khat</b>		
Yes	177	42.7
No	238	57.3
<b>Do you smoke cigarette</b>		
Yes	42	10.2
No	373	89.8
<b>Do you have any sleeping problem</b>		
Yes	209	50.4
No	206	49.6
<b>Are you satisfied with your current job</b>		
Satisfied	207	49.9
Neutral	45	10.8
Unsatisfied	163	39.3
<b>Are you satisfied with your current salary</b>		
Satisfied	59	14.2
Neutral	90	21.7
Unsatisfied	266	64.1

**Table 4** Training, Knowledge and Attitude on Workplace Safety and Health Among Small-Scale Metal Industries Workers in Central Ethiopia, 2023

Variables	Frequency	Percentage
<b>Training on metal work</b>		
Yes	95	22.9
No	325	77.1
<b>Training on work place safety and health</b>		
Yes	74	17.8
No	341	82.2
<b>Knowledge on work place safety and health</b>		
Poor	119	28.7
Fair	207	49.9
Good	89	21.4
<b>Attitude towards work place safety and health</b>		
Favourable	208	50.1
Unfavourable	207	49.9
<b>Practice towards safety measures</b>		
Good	163	39.3
Poor	252	60.7

**Table 5** Factors Associated with Compliance with Occupational Health and Safety Measures Among Small-Scale Metal Industries Workers in Central Ethiopia, 2023

Variables	Compliance with Occupational Health and Safety		COR (95% CI)	AOR (95% CI)
	Poor	Good		
<b>Monthly income (Birr)</b>				
≤1500	75(72.1)	29(27.9)	1	1
1501–5000	163(68.5)	75(31.5)	1.19(0.71, 1.97)	1.09(0.49, 2.44)
>5000	14(19.2)	59(80.8)	10.9(5.28, 22.5)	2.86(0.71, 11.5)
<b>Work title</b>				
Professional	177(57.1)	133(42.9)	1.87(1.16, 3.03)	1.75(0.75, 4.09)
Assistant	75(71.4)	30(28.6)	1	1
<b>Employment status</b>				
Permanent	192(59.1)	133(40.9)	1	1
Temporary	60(66.7)	30(33.3)	1.38(0.84, 2.26)	0.43(0.21, 0.93)*

(Continued)

**Table 5** (Continued).

Variables	Compliance with Occupational Health and Safety		COR (95% CI)	AOR (95% CI)
	Poor	Good		
<b>Work experience</b>				
<5 years	104(63.8)	59(36.2)	0.14(0.07, 0.27)	1.43(0.49, 4.19)
5–10 years	133(75.1)	44(24.9)	0.08(0.04, 0.16)	0.17(0.07, 0.41)***
>10 years	15(20)	60(80)	1	1
<b>Working at Night</b>				
Yes	58(43.9)	74(56.1)	2.78(1.18, 4.25)	4.08(1.5, 11.07)**
No	194(68.6)	89(31.4)	1	1
<b>Job satisfaction</b>				
Satisfied	103(49.8)	104(50.2)	2.73(1.75, 4.24)	0.36(0.12, 1.05)
Neutral	30(66.7)	15(33.3)	1.35(0.66, 2.75)	0.52(0.19, 1.4)
Unsatisfied	119(73)	74(27.8)	1	1
<b>Salary satisfaction</b>				
Satisfied	15(24.5)	44(74.6)	7.6(3.9, 14.5)	5(1.33, 19.27)**
Neutral	45(50)	45(50)	2.59(1.58, 4.24)	3.86(1.52, 9.8)***
Unsatisfied	192(72.2)	74(27.8)	1	1
<b>Training on metal work</b>				
Yes	21(22.1)	74(77.9)	9.14(5.31, 15.73)	5.75(2.56, 12.9)***
No	231(72.2)	89(27.8)	1	1

**Notes:** \*\*\*AOR of P-value significant at < 0.000, \*\*AOR of P-value significant at < 0.01, \*AOR of P-value significant at < 0.05.

The employment status of the workers was strongly associated with compliance, with temporary workers 57% less likely to adhere to safety precautions than permanently employed staff [AOR=0.43, 95% CI[0.21, 0.93]].

Employees in the metal sectors with 5 to 10 years of experience were 83% [AOR=0.17, 95% CI (0.07, 0.41)] less likely to comply with occupational health and safety precautions than those with more than 10 years of experience, according to the study.

Participants in the study who worked at night were four times more likely to comply with health and safety measures in place than those who did not work at night [AOR=4.08, 95% CI (1.5, 11.07)].

Respondent satisfaction with their current salary was also one of the associated factors, with those who are neutral and satisfied being 5 times [AOR=5, 95% CI (1.33, 19.27)] and 3.8 times [AOR=3.86, 95% CI (1.52, 9.8)] more likely to comply with safety precautions, respectively, than unsatisfied employees.

The findings showed that the odds of complying with occupational safety and health precaution among participants who take any health and safety training was 5 times higher as compared to did not take any health and safety training [AOR=5.75, 95% CI (2.56, 12.9)] (Table 5).

## Discussion

The primary goal of this study was to assess employees' adherence to workplace safety and health precautions. The study found a 39.3% (95% CI: 34.7, 44.1) prevalence of good compliance with safety and health measures among small-scale



metal workers. This finding was comparable to a study conducted in Uganda, which reported 37.1% good OHS practices among small-scale metal workers.<sup>20</sup> However, the study's compliance rate was substantially lower than that of earlier studies conducted in Ethiopia and Bangladesh, which showed compliance rates of 76.2% and 72.6%, respectively.<sup>19,21</sup> This difference may be attributed to the fact that the current study defines practice by taking into account many variables, such as PPE use and adherence to various norms, whereas other studies primarily focus on PPE consumption, which may be over-reported due to social desirability bias.

Participants who were permanent/employed full-time in small-scale industries were found to comply highly with health and safety precautions compared with temporary/part-time employed workers. Studies have suggested that permanently employed workers may exhibit a higher adherence to safety measures than temporary workers because of various factors, including permanently employed workers having a greater sense of job security and being more likely to prioritize their safety for the long term, and those workers may have more access to safety training and resources such as PPEs, safety manuals, and guidelines.<sup>22–24</sup>

Work experience was one of the factors influencing compliance with OHS measures, with less-experienced workers being less likely to adhere than most senior workers. Similarly, the findings of a study in Tigray, Ethiopia, revealed that employees who were the most experienced were more adherent to the available OSH precautions.<sup>19</sup> A possible explanation might be that experienced workers are more knowledgeable about safety measures in the workplace, and having good knowledge is associated with high compliance with safety precautions.<sup>25,26</sup>

The current findings revealed that safety compliance was related to working hours, with those who worked at night having good practices regarding workplace health and safety requirements. According to one study, night shift workers may be more cautious and comply with safety, since working at night can be more physically and psychologically demanding, and workers may be more aware of the significance of safety to avoid accidents or injuries connected with working outside of normal business hours.<sup>27</sup>

The results also revealed that metal workers who were satisfied with their existing income were more likely to adhere rigorously to health and safety requirements than those who were dissatisfied. Similarly, a study conducted in Bangladesh found that a high-income was associated with strong OHS practices.<sup>28</sup> This could be because job and salary satisfaction are frequently linked to a healthy work environment that fosters a sense of dedication and responsibility among employees, which favorably promotes safety behaviors, including compliance with safety procedures.

Workers who received workplace health and safety training performed better in terms of safety precautions than workers who did not receive training. Similarly, research in Nigeria and Uganda found that OHS training was directly related to good safety measure adherence behaviours.<sup>7,20</sup> Evidence from studies has also revealed that training plays a role in developing an understanding of occupational dangers, safety measures, and the need for safety precautions, consequently positively impacting compliance with safety precautions.<sup>29,30</sup>

## Strength and Limitation of the Study

The study's strength is that it investigated an area with scarce evidence. The main limitation of the study arises from social desirability bias. Though, to minimize the impact the study team tried to interview participants in a separate space and probe based on their observation.

## Conclusion

The study found that the rate of compliance with occupational health and safety measures is low among small-scale metal workers in the study area. The study also found that temporary employment and having less experience were associated with less adhere. The research also demonstrated a link between safety compliance with working time, level of satisfaction and salaries. The study highlights that attending health and safety trainings are associated with increased safety precautions. Overall, this study emphasizes the significance of increasing safety awareness through short-term onsite and offsite trainings in small-scale metal industries is vital to increase compliance with health and safety measure.

# Abbreviation

AOR, Adjusted Odds Ratio; CI: Confidence Interval; COR: Crude Odds Ratio; GDP: Gross Domestic Product; HBV: Hepatitis B Virus; OHS: Occupational Health and Safety PPE: Personal Protective Equipment.

# Data Sharing Statement

All the relevant data for the study were included in this study. The datasets are available upon reasonable request from the corresponding author (agziabel@gmail.com).

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# Disclosure

The authors declare no conflicts of interest in this work.

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