

# Compliance with Occupational Safety and Health Standards and Its Associated Factors among Workers of Roofing Factories in Rwanda

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## Abstract

### Background

An estimated 2.78 million work-related deaths and 374 million non-fatal injuries occur at workstations annually. Developing Countries place a low priority on safety, and many companies still operate without even the most basic health and safety procedures. Therefore, this research aimed to determine the level of compliance with occupational safety and health standards and their associated factors among roofing factory workers in Rwanda.

### Methods

A descriptive cross-sectional design was used. The study utilised a simple probability sampling technique with a sample size of 202 participants from the roofing industry. A structured questionnaire was utilized to gather primary data. The compliance level was the outcome variable. Univariate, Bivariate, and Multivariable analyses were conducted using SPSS version 25.

### Result

Analysis revealed that the compliance level was high (64%); the major challenge faced with occupational safety and health standards was lack of training (44.5%); the predicting factors to OSH compliance were age (36-45 years) (AOR=3.12, P-value=0.008, CI=1.35-7.21), being married (AOR=2.15, P-value=0.047, CI=1.01-4.58), and workers level of experience (16 years and above) (AOR=4.12, P-value=0.001, CI=1.76-9.64); these were statistically significant at P<0.05.

### Conclusion

Absence of training, age, marital status, and workers' level of experience influenced occupational safety and health compliance. Thus, refresher and constant training on compliance with occupational safety and health standards should be effectively and continuously carried out.

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**Keywords:** Compliance, Occupational Safety and Health, Roofing Factory workers, Rwanda

## Background

Each year, diseases or injuries related to the workplace claim the lives of about 2.3 million people globally.[1] Nearly 2 million deaths are caused by deadly work-related diseases (these are diseases or health disorders that are brought on by or made worse by elements in the workplace, such as exposure to dangerous substances, ergonomic risks, or stressful situations; these health disorders, which are frequently preventable, can range from acute conditions to long-term chronic illnesses), and over 350,000 deaths are the result of fatal accidents.[1,2] According to new ILO estimates, work-related illnesses and accidents claim the lives of about three million people annually, a rise of more than 5% from 2015.[2-4] The number highlights the ongoing difficulties in ensuring workers' health and safety on a global scale.

Work-related diseases account for the majority of these work-related deaths, which number 2.6 million deaths.[2-6] In addition, an extra 330,000 people die as a result of work-related accidents.[3-5] The top three causes of death at work are respiratory conditions, vascular disorders, and malignant neoplasms. Over three-quarters of all work-related deaths are caused by these three categories combined.[5-7]

Furthermore, non-fatal industrial accidents resulting in significant injuries and work absences affect more than 313 million workers.[2-4] Additionally, the International Labour Organization (ILO) estimates that 160 million non-fatal work-related sickness cases occur annually.[2-4] According to these statistics, 860,000 individuals are hurt at work every day, and 6,400 people die from illnesses or accidents related to their jobs.[1,5,7] These estimates indicate that occupational diseases account for about six times more worker deaths than occupational accidents, making work-related diseases the primary cause of death at work.[5,6] This data encourages employers to embrace a new preventative paradigm that addresses workplace diseases and occupational injuries.

There is a disparity in the global distribution of occupational death and morbidity among different industries and worker segments. Asia is thought to account for almost two-thirds (65%) of all work-related deaths worldwide. Africa (11.8%), Europe (11.7%), the Americas (10.9%), and Oceania (0.6%) follow.[5,7,8] Regional disparities are also evident in the rates of fatal occupational accidents per 100,000 workers; rates in Asia and Africa are four to five times higher than in Europe.[2] Therefore, the incidence of occupational disease and accidents is higher in developing nations than in developed nations. Additionally, 20% to 50% of industrial workers worldwide are prone to workplace dangers.[7,9] Furthermore, industries with the highest rate of work-related accidents are manufacturing, construction, transportation, and storage.[2] In addition, over 5,000 workers die in workplace accidents, and nearly 5 million are injured in ways that cause them to miss work annually.[5,6,10]

Roofing workers in Africa have a particularly low adherence to occupational safety and health (OSH) practices, which were developed and recommended by the ILO (these include procedures that are intended to discover, assess, and regulate workplace hazards to prevent work-related illnesses, injuries, and fatalities), which contributes to a high incidence of work-related injuries and fatalities.[11] This situation results from multiple factors such as a lack of safety training and knowledge, inadequate enforcement of regulations, limited use of personal protective equipment (PPE) and poor record-keeping and reporting.[12]

The Rwandan Labour Law of 2023, Article 133, requires employers to furnish their employees with the appropriate safety gear and to supervise its usage. Workers must correctly use protective gear and abide by internal health and safety rules.[13] Despite this law, each year, there is a rise in diseases and injuries linked to occupational health and safety in Rwanda.[12] Annually, the Rwanda Social Security Board (RSSB) estimates an increase of nearly 8,000

work-related mishaps and injuries. [14] However, corporate rules regarding occupational health and safety procedures and their actual application frequently diverge. Significant obstacles stand in the way of Rwandans adhering to OSH requirements, especially in the construction industry. Numerous small and medium enterprises (SMEs), such as those in the roofing industry, have challenges related to insufficient funding and inadequate safety standard training.[15] These elements play a part in the reduced rates of adherence to established OSH guidelines. Furthermore, the Government of Rwanda, in partnership with other organizations, has enforced stricter safety laws, monetary rewards for compliance, and inspection services, etc., to enhance compliance across all sectors.[15]

However, there is still a paucity of data regarding OSH compliance in the roofing sector in Rwanda. Based on this, this research sought to determine the predictors of compliance with OSH practices among workers in roofing factories in Rwanda.

## Methods

### Study design and setting

A descriptive cross-sectional design was used in the investigation of the factors associated with OSH compliance and its level among roofing workers. This method proved effective in evaluating the current compliance level of roofing factory workers regarding occupational health and safety. The Kigali Special Economic Zone in a Gasabo neighbourhood is home to the roofing industries (which produce roofing sheets) in Kigali, where this study was conducted. The roofing factories were Toliwa, Hippo and Safintra Limited.

### Study population and sample size

This research study focused on workers stationed in machine operation and supervisory positions within the production divisions. These positions were selected to accurately recruit participants

who are directly involved in high-risk (accident and injury-prone) departments. The sample size was calculated by using Yamane's formula.[16]

Formula:

$$n = \frac{N}{1+N(e)^2}$$

where :

n: the sample size

N: the population of the study

e: the margin error =5%=0.05

By applying the above formula

$$n = \frac{407}{1+407(0.05)^2} = 201.73 \approx 202 \text{ participants}$$

### Sampling strategies and procedures

The study used a simple random sampling technique, thereby giving each employee from the different factories an equal chance of being selected. Random numbers for these employees were generated using the Google tool (the minimum was 1 and the maximum number was 15); thereafter, every study participant with an even number was recruited.

### Inclusion Criteria

Personnel working in the production department of the roofing industry were included in the study. This was because the department houses more hazards and injuries than the administrative sections.

### Exclusion Criteria

Those in the production departments who were given administrative or cleaning duties or who were ill at that time were not included in the study.

### Data collection methods

A pretested and structured questionnaire was adapted and used to collect data for this study, which ascertained compliance with OHS regulations;[17,18] the questionnaire was divided into sections to assess respondent demographics, level of compliance and the challenges faced with OSH compliance. We recruited and trained research assistants using the questionnaire as a guide.

Primary data was collected from the workers during working hours at the work site. We used the Kobo Toolbox, a digital platform that facilitates accurate and rapid data collection, to collect, manage, and record data.

### **Reliability and validity of the instruments of data collection**

The researcher ensured the content validity of the questionnaire by constructing items that conformed to the study's variables. Before data collection, the questionnaire was pre-tested at a similar roofing factory to ensure reliability.

### **Measurement of Variables**

Questions on gender, age, marital status, educational background, position and work experience were asked to measure the independent variable, whereas the dependent variable (outcome) from this study was the compliance level with OSH practices; which included questions such as prioritization of OSH practices, frequency of safety inspections, availability of a safety officer, use of PPE, provision of refresher training, availability of standard operating procedures, first aid kit and visible safety signs.

### **Data Analysis**

All data were cleaned and analysed using SPSS version 25. Univariate, bivariate and multivariable analysis were done. The relationship between the outcome variable (OSH compliance) and the independent variables (gender, age, marital status, educational background, position and experience at the workplace) was examined using chi-square testing. There was a 5% test-level significance. Additionally, to get the mean score compliance level, we ranked each variable with a score, i.e. Low: <40, Moderate (Neutral): 40-69 and High: >70. Thereafter, the mean score of all moderates(s) to high(s) was computed to get the overall compliance level. This can be explained further thus: Prioritisation of OSH practices (Low was given a score of <40, Neutral 40-69, and High >70).

With regard to the frequency of safety inspections, annually and quarterly were scored as <40, Monthly was scored as 40-69, and daily and weekly were scored as >70.

Further more, for the variable on availability of a safety officer, use of PPE, provision of refresher training, availability of standard operating procedures, first aid kit and visible safety signs (No, represented low and yes represented high). Finally, for participation in safety drills, the variable of rarely was categorized as low, occasionally was coded as moderate and regularly was coded as high.

### **Ethical Considerations**

This study gained ethical clearance from the University of Rwanda, College of Medicine and Health Sciences Institutional Review Board (IRB). The IRB of the College approved this research with reference number CMHS/IRB/157/2024. In addition, permission was further sought from the Rwanda Development Board with approval number RDB/SEZ&E/011/2024. Study participants could stop taking part whenever they felt like it. In addition, participant consent was obtained before recruitment. Confidentiality was ensured by using numbers and codes for questionnaires and data analysis.

## **Results**

### **Participants Demographics**

All of the respondents were males, and most of them were in the category of 36-35 years of age (36.6%). Furthermore, the majority of them were married (81.7%) and had a secondary level education (63.9%). Concerning the variable of work position, most of the workers were machine operators (86.6%), and the greatest majority had 6-10 years of working experience (46%), Table 1.

**Table 1. Demographic characteristics of participants (N=202)**

Variable	n (%)
<b>Gender</b>	
Male	202 (100)
<b>Age</b>	
18-25 years	7 (3.5)
26-35 years	43 (21.3)
36-45 years	74 (36.6)
46-55 years	68 (33.7)
56 years and above	10 (5.0)
<b>Marital Status</b>	
Married	165 (81.7)
Single	37 (18.3)
<b>Educational Background</b>	
No formal education	1 (0.5)
Primary	56 (27.7)
Diploma	7 (3.5)
Secondary	129 (63.9)
Bachelor’s degree	9 (4.5)
<b>Position</b>	
Supervisor	27 (13.4)
Machine Operator	175 (86.6)
<b>Work Experience</b>	
0-2 years	7 (3.5)
3-5 years	31 (15.3)
6-10 years	93 (46)
11-15 years	39 (19.3)
16 years and above	32 (15.9)

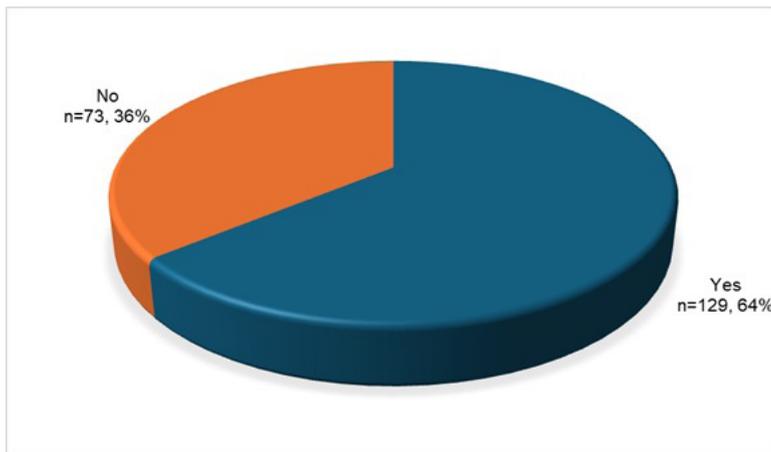
**Categories of Compliance with OSH Practices among Respondents**

For the variable of prioritization of OSH practices, most of the respondents reported a high level (77.2%). In addition, only 1% were the minority. Safety inspections were conducted monthly by the majority of the respondents (54.5%), while a few conducted them annually (1.5%). Most of the respondents reported that their factory lacked the presence of a safety officer or a safety team in the production department (51.5%); however, they utilized personal protective equipment (75.7%). Most of the respondents reported that their factory did not offer refresher training on OSH (72.3%).

With participation in safety drills, most workers participated occasionally (61.9%), while a few did it regularly (1.5%); in addition, the majority of respondents stated there was an existence of procedures for handling hazardous materials (75.7%). Finally, most respondents revealed that their factory has a first aid room/kit (60.4%), and there were visible and understandable safety signs in the department (72.8%), Table 2.

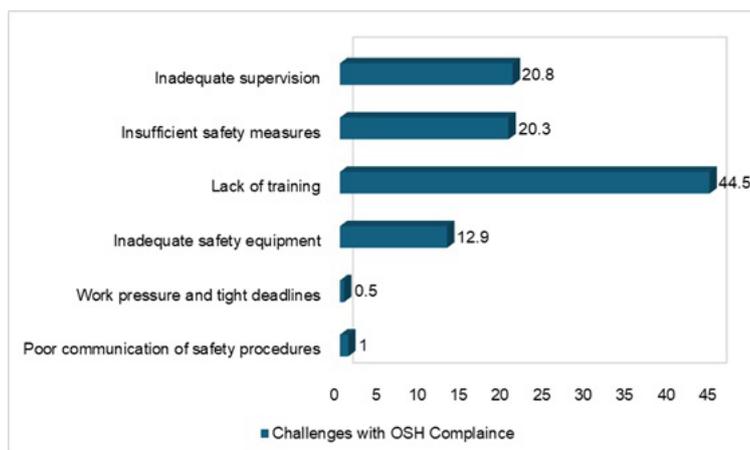
**Table 2. Categories of Compliance with OSH Practices (N=202)**

Variable	n (%)
<b>Prioritization of OSH practices</b>	
Very high	156 (77.2)
Neutral	44 (21.8)
Low	2 (1)
<b>Frequency of Safety Inspections</b>	
Annually	3 (1.5)
Quarterly	15 (7.4)
Monthly	110 (54.5)
Weekly	15 (7.4)
Daily	59 (29.2)
<b>The presence of a safety officer or team</b>	
No	104 (51.5)
Yes	98 (48.5)
<b>Use of PPEs</b>	
No	49 (24.3)
Yes	153 (75.7)
<b>Offering regular refresher training on OHS</b>	
No	146 (72.3)
Yes	56 (27.7)
<b>Participation in safety drills</b>	
Regularly	3 (1.5)
Occasionally	125 (61.9)
Rarely	74 (36.6)
<b>Existence of procedures for handling hazardous materials</b>	
No	49 (24.3)
Yes	153 (75.7)
<b>Availability of first aid room/kit.</b>	
No	80 (39.6)
Yes	122 (60.4)
<b>Visible and Understandable safety signs</b>	
No	55 (27.2)
Yes	147 (72.8)



**Figure 1. Percentage distribution of Occupational Safety and Health Compliance among Roofing Workers.**

After analysis, our results revealed that the percentage level of occupational safety and health compliance among the roofing workers was 64%, Figure 1.



**Figure 2. Challenges faced in complying with Occupational Safety and Health Standards**

The bar chart results revealed that the major challenge to complying with OSH practices was a lack of training (44.5%), while the minor challenges were work pressure, tight deadlines and poor communication of safety procedures (0.5%, 1% respectively), Figure 2.

**Binary logistic regression analysis**

The binary logistic regression analysis revealed that respondents' age (26–35, 36–45, and 46–55 years) significantly increases the odds of compliance compared with the youngest group (18–25 years). The 36–45-year group is the most compliant (AOR=3.12, P-value=0.008, CI=1.35–7.21).

In addition, married workers have more than double the odds of being compliant compared with single workers (AOR=2.15, P-value=0.047, CI=1.01–4.58). Furthermore, with regard to workers' educational level, those with primary education had significantly lower odds of compliance ( $\chi^2=15.610$ , AOR=0.42, P-value=0.028, CI=0.19–0.91) compared with those without formal education, thus they are less likely to be in the "Yes" compliant group.

Finally, respondents with the most experience (16 years and above) had over four times the odds of compliance ( $\chi^2=11.510$ , AOR=4.12, P-value=0.001, CI=1.76–9.64) compared with those of up to 2 years of experience; i.e., as workers' experience increases, so do the odds of compliance (Table 3).

**Table 3. Binary Logistic Regression of Respondents' Characteristics**

Variable	OSH Compliance		$\chi^2$	P Value	AOR	P Value	95% CI
	No (%)	Yes (%)					
<b>Age</b>							
18-25 years (Ref)	5(71.4%)	2(28.6%)			1	-	-
26-35 years	20(46.5%)	23(53.5%)			2.45	0.032*	1.08-5.56
36-45 years	23(31.1%)	51(68.9%)			3.12	0.008*	1.35-7.21
46-55 years	21(30.9%)	47(69.1%)			2.89	0.012*	1.26-6.63
56 years and above	3(30%)	7(70%)	7.604	0.107	2.15	0.154	0.74-6.22
<b>Marital Status</b>							
Single (Ref)	17(45.9%)	20(54.1%)	2.096	0.148	1	-	-
Married	55(33.3%)	110(66.7%)			2.15	0.047	1.01-4.58
<b>Educational Background</b>							
No formal education (Ref)	0(0%)	1(100%)	15.610	0.004**	1	-	-
Primary	11(19.6%)	45(80.4%)			0.42	0.028*	0.19-0.91
Secondary	51(39.5%)	78(60.5%)			0.61	0.185	0.30-1.26
Diploma	6(85.7%)	1(14.3%)			0.71	0.542	0.23-2.16
Bachelor's degree	4(44.4%)	5(55.6%)			0.9	0.842	0.33-2.46
<b>Position</b>							
Machine Operator (Ref)	57(32.6%)	118(67.4%)	5.387	0.020*	1	-	-
Supervisor	15(55.6%)	12(44.4%)			1.28	0.482	0.64-2.54
<b>Work Experience</b>							
0-2 years (Ref)	5(71.4%)	2(28.6%)	11.510	0.021*	1	-	-
3-5 years	14(45.2%)	17(54.8%)			1.52	0.327	0.66-3.51
6-10 years	37(39.8%)	56(60.2%)			2.78	0.018*	1.19-6.49
11-15 years	10(25.6%)	29(74.4%)			3.45	0.005*	1.45-8.21
16 years and above	6(18.8%)	26(81.3%)			4.12	0.001*	1.76-9.64

\*Sig at P&lt;0.05.

## Discussion

This research sought to determine the level of adherence to OSH practices among workers in roofing factories and their associated factors. With regard to compliance, the study respondents reported a 64% OSH compliance level. This shows that the adherence level was relatively high. This aligns with 60-70% compliance rates among roofing workers in the United States,[19] 75-85% in Europe,[20] and 70-80% in Australia.[21] However, some Countries had their adherence levels among roofing workers below 60%; such as Ghana, 45-50%,[22] Nigeria, 30-40%,[23] and the Philippines, India and Malaysia, 40-55%.[24] These countries' lower findings not aligning with ones in this research might be attributed to the Rwandan government's

involvement in safety standards, monitoring and evaluation, the private sector's adherence to safety laws and accident reporting, and good record keeping by the Ministry of Health and the Ministry of Labour. Despite the OSH compliance level being above average in this research, majority of respondents reported a lack of training (44.5%) and supervision (20.8%) as challenges to compliance; therefore, more sensitization and frequent refresher training on safety adherence should be enforced by a joint venture of Public-Private Partnerships. This measure will create a sense of ownership of the safety guidelines by the worker (employee), as was done with helmet compliance among motorbike drivers in Rwanda and Uganda.[25-27]

Concerning the demographic factors, this research revealed that as the respondents increased in age, the tendency to comply with OSH practices also increased; in addition, roofing workers who were married had double the odds of compliance than their single counterparts. Furthermore, the educational levels (primary education) of the respondents predicted adherence to OSH practices, which was statistically significant. This was in line with similar research from Ethiopia[28] and Taiwan[29], which stated that the education level of workers influences their compliance with occupational safety and health (OSH) standards at the workplace. This can stem from the fact that they might not have other attributes that would make them employable in the formal sector; thus, they desire to make the best out of their blue-collar jobs to meet their economic demands.[30]

In addition, the level of experience of the roofing workers also predicted adherence to OSH practices. Findings from this study revealed that respondents with an experience level of 16 years and above were four times at odds to comply with OSH standards than other levels. It is also stated globally that a worker's experience is directly associated with their compliance level with OSH standards.[31] In addition, workers who have longer job experience and have encountered workplace accidents are more likely to abide by all safety precautions than their counterparts who have perceptions of job insecurity.[32,33]

Finally, the findings on machine operators can be attributed to the fact that workers whose supervisors are safety cautious tend to align with their supervisor's ideology. [33,34]

### **Limitations and strengths of the study**

Because this case study was restricted to the roofing factories located within the Kigali Special Economic Zone, the findings from this research study might not apply to the entire manufacturing sector in Rwanda. In addition, due to the study design, some respondents might have reported inaccurate

responses due to fear of supervisors. However, this study provides valuable insights into real safety challenges which help to prevent avoidable injuries and fatalities. It also fills an evident knowledge gap in Rwanda within manufacturing subsectors, which can guide policy and industry interventions.

### **Conclusion**

This research study sheds light on compliance levels and associated factors with OSH standards among factory workers in the roofing department in Rwanda. It concludes that the compliance level was high (64%) and the associated factors among the respondents that prompted them to comply with these standards effectively were age (36-45 years), being married, educational levels (primary), and worker experience (16 years and above). This implies that age, marital status, level of education, and experience of a roofing worker makes them likely to adhere to OSH practices and standards.

Thus, from the findings of this research, we recommend that effective monitoring and training for all cadres of workers be regularly evaluated. Furthermore, managers and supervisors should enact and implement policies compelling all workers, irrespective of their cadre, to adhere to OSH practices while at the workplace. Finally, more observational research in similar sectors should be conducted to understand and make available data on OSH compliance at the workplace.

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### **Competing Interests**

The authors declare no competing interests.

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