

# Personal Protective Equipment Utilization and Associated Factors among Industry Park Construction Workers in Northwest Ethiopia

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Tewodros Yosef<sup>1,2</sup> and Nigusie Shifera<sup>1</sup>

<sup>1</sup>School of Public Health, College of Medicine and Health Sciences, Mizan-Tepi University, Mizan Teferi, Ethiopia. <sup>2</sup>School of Medicine, Faculty of Health, Deakin University, Waurn Ponds, Australia.

## ABSTRACT

**INTRODUCTION:** Equipment that safeguards the user from the risk of accidents or harmful health effects is known as personal protective equipment. Reports show personal protective equipment utilization is low in Africa. Workers are exposed to a wide range of physical, chemical, and incidental hazards because of low utilization of personal protective equipment. Therefore, this study aimed to assess the magnitude and factors associated with personal protective equipment utilization among Bure Industrial Park construction workers, Northwest Ethiopia.

**METHODS:** A cross-sectional study involving 368 construction workers was carried out. The questionnaire was prepared to collect data on sociodemographic, work-related, and behavioral characteristics. Personal protective equipment usage was assessed by observation. Descriptive statistics' frequencies, proportions, and means were computed, and the analysis results were presented in text and tables. To find independent variables associated with personal protective equipment utilization, bi-variable and multivariable logistic regression analyses were performed.

**RESULTS:** The proportion of workers at the Bure Industrial Park who utilized personal protective equipment was 47.8%, 95% CI (47.7-47.9). After adjusting employment type as a confounding factor; not being a substance user [AOR = 9.52, 95% CI (5.07-17.8)], regular workplace supervision [AOR = 4.09, 95% CI (1.26-5.48)], having occupational safety training [AOR = 6.01, 95% CI (2.05-17.6)], and provision of personal protective equipment at workplace [AOR = 7.36, 95% CI (3.97-13.6)] were the factors associated with personal protective equipment utilization.

**CONCLUSION AND RECOMMENDATION:** Nearly 1 in 2 workers wear PPE at work. Lack of PPE utilization is a public health problem in the study area. According to the study, personal protective equipment utilization was influenced by behavioral and occupational factors. To increase the utilization of personal protective equipment, training in safety procedures and regular workplace supervision must be considered.

**KEYWORDS:** PPE, occupational safety, construction workers, Bure, Amhara region, Ethiopia

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**CORRESPONDING AUTHOR:** Tewodros Yosef, School of Public Health, College of Medicine and Health Sciences, Mizan-Tepi University, P.O.BOX: 260, Mizan Teferi, Ethiopia. Email: tewodrosyosef47@mtu.edu.et

## Introduction

Around 270 million occupational injuries occur each year, and there are 2 million fatalities, according to the ILO.<sup>1</sup> Occupational illnesses or accidents claim 6300 people per day.<sup>2</sup> Construction is one of the most risky professions since workers there are more likely to get hurt or have accidents than those in other professions.<sup>3-5</sup> Unsafe working environments and unsafe employee behavior, such as disregard for safety gear and failure to follow safety procedures on job sites, have been identified as the main contributors to work-related accidents.<sup>6</sup>

Equipment that safeguards the user from the risk of accidents or harmful health effects at the workplace is known as personal protective equipment (PPE).<sup>4,7-12</sup> It may include safety boots, gloves, respiratory protective equipment, high-visibility clothes, safety helmets, and eye protection.<sup>12</sup> To decrease occupational illnesses and injuries at work, PPE

utilization is a global legal obligation.<sup>13</sup> Accident risk can be dramatically raised by inadequate risk management strategies, such as utilizing PPE improperly or not at all. For construction workers, proper PPE use is essential and can make the difference between accidents and safety.<sup>3</sup>

Construction industry workers operate in a very dangerous environment.<sup>14</sup> Construction workers should use PPE for protection. Because it shield them from contact with or exposure to hazardous substances that could result in illness, injury, or even death.<sup>15</sup> PPE use is low among construction workers and has a substantial association with safety training. This is the fact that workplace accidents are common and strongly connected to safety training and PPE use.<sup>3</sup> Reports show PPE use is minimal in Africa.<sup>16-19</sup> Due to the low usage of personal protective equipment (PPEs), workers are exposed to a variety of physical, chemical, and incidental hazards.<sup>20</sup>



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About half of Ethiopia's workforce suffer from occupational injuries, and not wearing personal protective equipment was a major factor.<sup>21</sup> There has only been one study done among construction workers in Addis Ababa, Ethiopia, and it found that 38% of them used personal protective equipment. The study also discovered that the factors linked to PPE usage were the availability of training on its use. In addition, the availability of safety training, the presence of safety orientation prior to starting work, and the availability of supervision. Despite a study on this topic conducted in Addis Ababa, Ethiopia,<sup>13</sup> the subjects were more urban. However, this study used more rural study populations. As a result, this study was conducted expecting different findings. Therefore, this study aimed to assess the magnitude and factors associated with personal protective equipment utilization among Bure Industrial Park construction workers, Northwest Ethiopia.

## Methods

### *Study design, area, period, and populations*

Between January and February 2022, cross-sectional research was conducted among construction workers in Bure Industrial Park. The Amhara region's Bure town administration Industry Park is located 411 km north-west of Ethiopia's capital city Addis Ababa. The park has given thousands of local residents employment opportunities. The workforce varies seasonally, ranging from 1500 to 2000. The source population was made up entirely of construction workers from Bure Industry Park.

### *Sample size determination and sampling technique*

The sample size was determined using a single population proportion calculation. It was assumed that the town of Debre Birhan had a prevalence rate of personal protective use of 35.43%.<sup>18</sup> A final sample size of 387 was determined with a confidence level of 95%, a requirement of precision of 5%, and an additional 10% for non-response rates. First, Bure Industrial Park administration provided a list of construction workers with their corresponding job classifications. The study participants were then chosen using a straightforward random sampling approach. The next participant was considered if the chosen participant wasn't available when the data were being collected.

### *Study variables*

Construction workers' utilization of personal protection equipment served as the outcome variable. Age, sex, marital status, education level, and monthly income were sociodemographic and economic independent factors. Work-related independent variables included type of employment, occupational safety training, personal protective equipment (PPE), and routine workplace supervision. Substance use (like alcohol, khat, and cigarettes) was the single behavioral factor.

### *Operational definitions*

Workers are required to wear specialized clothes or equipment called personal protective equipment (PPE) to protect themselves from health and safety risks. Workers were classified as those who used PPE when they were observed wearing PPE that were necessary to be used during a particular activity, otherwise not.<sup>22</sup> The condition of being present was used to describe the availability of PPE.<sup>23</sup> A person who used at least one of the following substances, such as alcohol, khat, or cigarettes, within the previous 30 days was considered a substance user.<sup>24</sup>

### *Data collection tools, procedures, and quality assurance*

After researching the pertinent literature, an interviewer-administered structured questionnaire was created. To maintain continuity, the translation was first done in English, then into Amharic, and finally back into English. Data collection was conducted using Amharic, the local language. The questionnaire was composed of socio-demographic, work-related, and behavioral characteristics. The questionnaire was examined for reliability and validity. Face validity was conducted by a university lecturer who was an occupational health expert. The reliability of the analysis was tested using Cronbach's alpha, and the reliability coefficient was substantial (Cronbach's alpha: .79). Prior to real data collection, a pretest was performed on 5% of the sample population. Data collectors and their supervisors received 2 days of training on the questionnaire and data gathering techniques. Three BSc nurses who had prior experience with data collection collected the data. Two public health officers with BSc degrees oversaw the entire data collection procedure.

### *Statistical analysis*

The data was coded, entered, and exported to SPSS version 20 for statistical analysis after being coded and entered in Epi Data version 3.1. Frequencies, proportions, and means were determined in descriptive statistics, and the analyses' findings were then presented in text and tables. Analyses of the associations between various independent variables and the dependent variable were conducted by binary logistic regression. Multivariable logistic regression analysis was used to control for potential confounding factors. For the final multivariable logistic regression analysis, independent variables with a binary logistic regression analysis  $P < .25$  were considered candidates.  $P$ -values lower than .05 were used to determine the significance threshold.

## Results

### *Socio-demographic characteristics and job categories*

A response rate of 95.1% was obtained from the 368 study participants who completed the interview out of the 387 total sample sizes. Participants' ages ranged from 16 to 47 years old,

**Table 1.** Socio-demographic characteristics of the Bure industry park construction workers, Northwest Ethiopia.

VARIABLES	CATEGORIES	FREQUENCY (%)
Sex	Male	179 (48.6)
	Female	189 (51.4)
Age (y)	≤25	74 (20.1)
	26-35	184 (50)
	36-45	92 (25)
	≥46	18 (4.9)
Marital status	Single	191 (51.9)
	Married	169 (45.9)
	Divorced	8 (2.2)
Educational status	No formal education	12 (3.3)
	Primary school (1-8)	282 (76.6)
	Secondary and above	74 (20.1)
Monthly salary (Ethiopian Birr)	<3444	196 (53.3)
	≥3444	172 (46.7)

with a mean age of 27.2 ( $\pm 8.4$  SD). One hundred ninety-one (51.9%) of the individuals were single, followed by 169 (45.9%) who were married. The participants' average monthly pay was 3444 Ethiopian Birr ( $\pm 1449$  SD), ranging from 1800 to 6000. Of the 368 survey participants, daily laborers made up 41.8% of the population, followed by masons with 29.9% and carpenters with 9.8% (Table 1).

#### *Work-related and behavioral profiles*

Fifty-four (14.7%) of the participants received occupational safety training at work. Of the participants, more than three-fourths (80.4%) had consistent workplace supervision. One hundred sixty-five (44.8%) and 205 (55.7%) of the participants, respectively, used drugs at work and had PPE available to them (Table 2).

#### *Prevalence of PPE utilization and its associated factors*

The percentage of Bure Industrial Park workers that utilized personal protective equipment was 47.8%, 95% CI (47.7-47.9) (Table 2). After adjusting for employment type as a confounding factor; not being a substance user [AOR=9.52, 95% CI (5.07-17.8)], regular workplace supervision [AOR=4.09, 95% CI (1.26-5.48)], having occupational safety training [AOR=6.01, 95% CI (2.05-17.6)], and provision of PPE at workplace [AOR=7.36, 95% CI (3.97-13.6)] were the factors associated with personal protective equipment utilization (Table 3).

**Table 2.** Personal protective equipment utilization, work-related and behavioral profiles of the Bure industry park construction workers, Northwest Ethiopia.

VARIABLES	CATEGORIES	FREQUENCY (%)
Utilization of PPE	Yes	176 (47.8)
	No	192 (52.2)
Employment type	Permanent	29 (7.9)
	Others <sup>#</sup>	339 (72.1)
Work section/ category	Daily labor	154 (41.8)
	Mason	140 (29.9)
	Carpenter	36 (9.8)
	Welder/electrician	20 (5.4)
	Site engineer	20 (5.4)
	Plasterer	14 (3.8)
	Painter	10 (2.7)
	Operator/driver	4 (1.1)
Provision of PPE at workplace	Yes	205 (55.7)
	No	163 (44.3)
Occupational safety training	Present	54 (14.7)
	Absent	314 (85.3)
Regular workplace supervision	Present	296 (80.4)
	Absent	72 (19.6)
Substance use	Yes	165 (44.8)
	No	203 (55.2)

Others<sup>#</sup>: Temporary/contract.

## Discussion

Without the utilization of personal protective equipment and protective clothes, appropriate protection against the risk of accident or injury to health, including exposure to unfavorable conditions, cannot be guaranteed.<sup>25</sup> Based on the circumstances, this study evaluated the extent to which Bure Industrial Park construction workers in North-west Ethiopia use personal protection equipment utilization, as well as the associated factors.

The magnitude of personal protective equipment utilization was 47.8%, 95% CI (47.7-47.9). This finding was higher than 38% in Addis Ababa,<sup>13</sup> 35.43% and 41.7% in Debre Birhan<sup>18,26</sup> studies in Ethiopia, and 15.6% in Kampala, Uganda.<sup>17</sup> However, this finding was lower than 54% in Adawa<sup>27</sup> and 82.4% in Hawassa<sup>8</sup> studies in Ethiopia, 60% in Egypt,<sup>3</sup> 86.4% in Nigeria,<sup>28</sup> and 87.2% in Nawalparasi,

**Table 3.** Factors associated with personal protective equipment utilization among Bure industry park construction workers, Northwest Ethiopia.

VARIABLES	CATEGORIES	PERSONAL PROTECTIVE EQUIPMENT UTILIZATION		COR (95% CI)	AOR (95% CI)
		YES	NO		
Employment type	Permanent	21	8	3.12(1.34-7.23)**	2.68(0.62-11.6)
	Others <sup>#</sup>	155	184	1	1
Provision of PPE at workplace	Yes	31	108	6.01 (3.72-9.73)**	7.36 (3.97-13.6)**
	No	145	84	1	1
Occupational safety training	Present	36	18	2.49 (1.35-4.57)**	6.01 (2.05-17.6)**
	Absent	140	174	1	1
Regular workplace supervision	Present	53	19	3.92 (2.21-6.96)**	4.09 (1.26-5.48)**
	Absent	123	173	1	1
Substance use	Yes	29	136	1	1
	No	147	56	12.3 (7.43-20.4)**	9.52 (5.07-17.8)**

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; PPE, personal protective equipment.

Others<sup>#</sup>: Temporary/contract.

\*\* $P < .001$ .

Nepal.<sup>11</sup> The socio-demographic, occupational, and behavioral factors, differences across different studies may create a significant variation.

PPE utilization could be predicted independently by availability. Those who offered PPE were 7.4 times more likely to use it. This finding was consistent with studies conducted in Hawassa, Ethiopia,<sup>8</sup> and Nigeria.<sup>10,28</sup> A possible explanation could be because workers did not buy the required PPE for themselves if the employer did not provide it. This results in less utilization of PPE among those who were not offered PPE by the employer. As a result, an employer should provide appropriate PPE if workers need it.<sup>29,30</sup>

In this finding, PPE utilization was significantly associated with occupational safety training. The likelihood of utilizing PPE was 6 times higher among those who received occupational safety training than those who did not. This finding was consistent with several studies conducted in Ethiopia.<sup>3,18,27,31</sup> The reason could be improved awareness due to the organization's safety training program.<sup>18</sup> This indicates that training must be planned so that workers can utilize PPE more effectively.<sup>32</sup>

Regular workplace supervision was statistically associated with PPE utilization. Employer-supervised workers were 4 times more likely to use PPE. This finding was supported by studies conducted in Addis Ababa,<sup>13</sup> and Debre Birhan<sup>18</sup> studies in Ethiopia. This might be because workplace supervision is critical for recognizing risks and monitoring non-compliance. To identify hazards and encourage the use of PPE, monitoring

the workplace should be a key component of workplace safety programs.<sup>32,33</sup>

Personal protection equipment use was linked to substance use behavior. The likelihood of utilizing PPE was 9.5 times higher among those who did not use substances than among those who did. This conclusion was reinforced by Tadesse et al,<sup>8</sup> who found that drug users are less likely to use PPE because they take more risks. This result, however, was at odds with a study in Kombolcha, Ethiopia.<sup>31</sup>

### Strengths and Limitations

To the extent of our knowledge, this study was the first in the northern part of Ethiopia and the second in Ethiopia. However, it is also challenging to show causal relationships between the dependent and independent variables because of the cross-sectional nature of the study.

### Conclusion and Recommendations

Nearly 1 in 2 workers wear PPE at work. Lack of PPE utilization is a public health problem in the study area. According to the study, personal protective equipment PPE utilization was influenced by behavioral and occupational factors. To increase the utilization of personal protective equipment, training in safety procedures and regular workplace supervision must be considered.

### Availability of Data and Materials

The corresponding author oversees the data set, which is available upon request.



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## Author Contributions

TY; NS: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

## Ethical Approval and Consent to Participate

The Mizan-Tepi University Ethical Review Committee approved the project. The information acquired from the respondents was kept private and confidential; only the ID number was utilized during data collection, analysis, and reporting, and only the data collectors and the principal investigator had access to it. The Declaration of Helsinki served as the basis of our investigation. Participants provided written informed consent to participate in the study.

## Consent for Publication

Not applicable.

## ORCID iD

Tewodros Yosef  <https://orcid.org/0000-0002-3173-6753>

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