

## Knowledge of occupational health hazards and practice of personal protective equipment among fabrication workers in Kathmandu district, Nepal

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### ABSTRACT

**Background:** Fabrication work is one of the hazardous occupations in which workers are exposed to different occupational hazards and injuries. But the workers lack proper knowledge about protecting themselves from those hazards. This study was conducted, to assess knowledge about occupational health hazards among fabrication workers and to find out the practice of Personal Protective Equipment (PPE) in fabrication works.

**Methods:** A cross-sectional study was conducted among 394 fabricator workers of Kathmandu District by using a multi-stage sampling technique. Participants were interviewed with a pre-tested semi-structured questionnaire.

**Results:** All the participants were male, and their age ranged from 19-60 years with the mean age of 32.3 years. 71.3% of participants had work-related health complains, among which arc eye (85.76%) was the most common. Among them, 87.1% had at least used one PPE. There was a significant association between awareness about occupational hazards and work experience of fabrication workers ( $p=0.001$ ), and the practice of PPE with religion ( $p<0.01$ ).

**Conclusion:** This study found that fabrication workers were aware of occupational hazards and the use of PPE during the fabrication work. But the practice of PPE was not enough to protect them from the occupational hazards.

**Key words:** Burns, Fabrication workers, Occupational hazards, Personal Protective Equipment.

### Introduction

Occupational health and safety (OHS) is defined as a concept of protecting the employees from impending harmful effect in the workplaces by early identification of the risks and timely intervention to prevent fatal and non-fatal accidents to the workers and the surroundings.<sup>1,2</sup> OHS is a multidisciplinary approach aimed at improvement of the health and potential of the workers, to create an effective and conducive work environment for the safety of the workers and to develop and implement a rational set

of policies for organizational development and better work ethics. OHS plays a vital role to overcome the health hazards.

An occupational hazard is a risk harming the health of the workers at the workplace either immediately or after prolonged exposure. There are various types of hazards such as Physical, Chemical, Biological, Psychological, Mechanical and Ergonomic hazards.<sup>1</sup> Based on severity or duration, it can be classified into acute and chronic effects such as burn, fracture, foreign body in the eye, hearing loss, bronchitis, and back pain etc.<sup>3,4</sup> Since fabrication workers are directly exposed to different accidental and non-accidental types of hazards, early diagnosis of hazards and regular use of control measures in a workplace is an appropriate preventive measure against fabrication related occupational hazards.<sup>5</sup>

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Personal Protective Equipment (PPE) is the equipment used to prevent serious workplace illness and injuries by limiting exposure to continuous contact with physical, chemical, radiological, electrical and mechanical hazards. Equipment used for protection during fabrication is different according to hazards and body parts it is protecting.<sup>6,7</sup>

According to International Labor Organization (ILO) in 2015, 2.3 million people die at work from injury or disease related to their occupation and 2 million of them die due to fatal work-related diseases whereas more than 313 million were non-fatal accidents per year.<sup>8</sup> Only 15 % of workers have access to an assessment of occupational health risk, health surveillance, training for safe working method and first aid.<sup>9</sup>

The concept of occupational health and safety is evolving in Nepal. The first Labor Act was promulgated in 1992 A.D.<sup>10</sup> The new Labor Act was launched in 2017 A.D. ensuring the provision for the rights, facilities, and safety of workers in the enterprises with even a single person at work.<sup>11</sup> Though fabrication work is a skillful occupation which is being carried out since ancient time,<sup>12</sup> majority of fabrication workers learn their job without any formal training and supervision, thus lack:

- i. Proper knowledge about fabrication work
- ii. Proper use of PPE
- iii. Proper knowledge about health hazards.

The prevalence of occupational health effects seems to be 90.7% according to a study conducted in the eastern part of Nepal.<sup>12,13</sup> Thus, this study aimed to assess knowledge about occupational health hazards and the practice of Personal Protective Equipment (PPE) among fabrication workers.

## Methods

A cross-sectional analytic study was conducted from March 2018 to September 2018 in Grill and steel fabrication workers of Kathmandu District, Nepal. Since not much study has been done in this field, the prevalence rate of 50% was taken into consideration. The sample size was calculated using formula

$$\text{Sample size (n)} = \frac{Z^2 \cdot p \cdot q}{d^2} = \frac{(1.96)^2 \times 0.5 \times 0.5}{0.05^2}$$

$$= 384.16 \approx 385$$

Where, Z= 1.96, at confidence level of 95%  
P = Prevalence =50% =0.5

$$q = (1-p) = (1-0.5) = 0.5$$

$$d = \text{margin of error of } 5\%$$

Including 5 % non-response rate we planned to interview 405 fabrication workers.

A multistage sampling technique was used during the study where primary data of fabrication workers was obtained from the office of the Federation of Grill and Steel Fabricators Nepal. According to the available information, there were two local area committees of fabrication workers in Kathmandu that is East and West with 9 and 5 Units respectively. Out of those Units, 5 from East and 3 from West were selected by using Simple Random Sampling. From those selected Units, 203 workshops were selected using Population proportional to size (PPS). Taking two fabrication workers from selected workshops required sample size was reached by using convenience sampling. Fabrication workers both male and female of age 18 years and above, who have been working for 6-8 hours a day for at least 6 months in this field were included in the study. Fabrication workers with a history of any preexisting comorbidity were excluded. Data collection was done by interview method using pretested structured questionnaires. Ethical clearance was obtained from the Institutional Review Committee (IRC) of Kathmandu Medical College. Before collecting data, all the participants were informed in detail about the study and written consent was taken. Confidentiality of the participants was maintained. The collected data were entered in MS Excel and exported to the Statistical Package for Social Sciences (SPSS) version 25 for analysis.

## Results

Data were collected from a total of 394 fabrication workers who agreed to participate in the study. Twelve respondents denied participating in the study, so the response rate was 97% (394). All the respondents of the study were male with a mean age of 32.30 years and Standard Deviation of 9.58 years. Majority of the respondents belonged to 25-34 years age group. In total 86 % were Hindu by religion, 81.7% Janajati by ethnicity and more than 50 % of fabrication workers were educated up to the secondary level of education.

Almost one fourth (24.6%) of respondents had work experience of fewer than 5 years whereas, 98.2% were trained for work through apprenticeship. Most of the respondents reported working for less than 8 hours

a day. During the study, electric welding (99.7%) was commonly practiced where most of them reported doing grinding, welding, cutting, painting, and hammering as a part of their job. But none were involved in chemical cleaning of metal.

Occupational health effect of fabrication work was divided into two sections that were physical injuries during fabrication and work-related health complains. In the first section, all of the respondents replied that they were injured during fabrication work within the last year. The most common type of injuries was cuts and burns which occurred during grinding and welding of metals. The majority of the fabrication workers reported that their eyes (99.2%) and hands were the commonest parts affected by fabrication work. (Table 1)

In the second section, out of 394 fabrication workers, 281 (71.3%) had health-related complains within the last one year of working. Arc eyes (85.76%) were the most common injuries related to fabrication work followed by headache (25.26%), cough (24.91%), back pain (24.55%) and Skin Irritation (20.28%). (Table 2)

Among the total respondent, 54.44% reported that the health problems had affected their daily work activities. Half of the fabrication workers (49.7%) had visited hospitals for the treatment and 43.7% had received the first aid at their workplace.

The study showed that all the respondents were aware of occupational hazards in fabrication work. Electricity (100%) was the commonest hazard in fabrication work followed by sharp edge metal (98.5%), flying sparks (93.1%) and bright light (90.4%). (Figure 1)

All the respondents had used at least one PPE for six different body parts (Head/Eye, Ears, Nose and mouth, Upper Limb, Lower Limb, Body/ Trunk). Among them, sunglasses (99.7%) for eyes, cotton face mask

(94.9%) for nose and mouth, insulated gloves (97.9%) for upper limbs, and ordinary shoes (93.8%) for lower limb protection were most commonly practiced as PPE. Similarly, few respondents had used PPE for the protection of their trunk and none of the respondents had used any of the PPE for the ear. (Table 3)

There was a significant difference between the work experience and awareness of occupational hazards among fabrication workers ( $p=0.001$ ). Higher the experience in fabrication work had better awareness about occupational hazards. But there was no significant difference in awareness about occupational hazards with the duration of work per day and training. (Table 4)

There was a significant difference between the practice of PPE with the religion of respondents ( $p=0.01$ ). But there was no significant difference in knowledge about PPE with age and education level of fabrication workers ( $p > 0.05$ ). (Table 5)

Interestingly respondents who had good knowledge about PPE had nearly one hundred- and forty-times higher odds of having good practice of personal protective equipment [COR: 140.05; 95%CI 31.49-624.79] and this association was found to be statistically significant ( $p<0.001$ ). (Table 6)

In multivariate analysis, the respondents who had worked for more than eight hours per day were found to have less practiced PPE (AOR: 0.39; 95% CI 0.17-0.88) as compared to those who have worked less than eight hours per day which was found to be statistically significant ( $p=0.02$ ). Similarly, the respondent who had good knowledge about PPE had nearly one hundred fifty times higher odds of using PPE (AOR: 150.24; 95% CI: 29.76-758.46) which was also statistically significant since p-value was less than 0.001.

**Table 1:** Distribution of injuries and body part affected within 1 year\*

Variables	Number of workers (n)	Percentage (%)
<b>No. of injuries per year</b>		
≤ 7	222	56.3
>7	172	43.7
<b>Injuries during fabrication*</b>		
Cuts	392	99.5
Broken bones	15	3.8
Sprain	12	3
Burns (spark injuries)	393	99.7

Variables	Number of workers (n)	Percentage (%)
<b>Body parts affected *</b>		
Eyes	391	99.2
Head	2	0.5
Neck	1	0.3
Hands	365	92.6
Legs	296	75.1
Back	3	0.8
<b>Work during injury*</b>		
Grinding	380	96.4
Welding	355	90.1
Hammering	52	13.2
Cutting	5	1.3

\*Multiple responses

**Table 2:** Distribution of work-related health complains\* (n=281)

Parameter	Frequency(n)	Percentage (%)
<b>Health Complains</b>		
Arc eyes	241	85.76
Headache	71	25.26
Cough	70	24.91
Back Pain	69	24.55
Skin Irritation	57	20.28
Breathing Problem	13	4.62
Hearing Impairment	1	0.35

\*Multiple Responses

**Table: 3** Distributions of PPE practiced among the respondents \*

Body Parts	Variables	Frequencies (n)	Percentage (%)
Head /Eye	Safety glass	2	0.5
	Hand shield	26	6.6
	Welding helmet	21	5.3
	Sunglass	393	99.7
Ear	Ear plug	0	0
	Cotton	0	0
Nose and mouth	Face mask	351	94.9
	Respirator	0	0
Upper Limbs	Insulated gloves	380	97.9
	Surgical gloves	0	0
	Woolen gloves	20	5.15
Lower limbs	Safety boots	16	4.1
	Ordinary shoes	365	93.8
	Slipper	47	12.1
Body /Trunk	Work suit	2	1.3
	Jeans apron	4	2.5

\*Multiple Responses

**Table 4:** Factor associated with awareness about occupational health hazards among fabrication workers

Variables	Awareness about Occupational health hazards		COR (95%CI)	p-value
	Good	Poor		
<b>Work Experience (in months)</b>				
<61	49(50.5%)	48(49.5%)	0.68(0.37-1.23)	0.001
61-120	32(42.7%)	43(57.3%)	0.49(0.26-0.94)	
121-180	45(60.8%)	29(39.2%)	1.03(0.54-1.97)	
181-240	21(30.9%)	47(69.1%)	0.29(0.15-0.58)	
>240	48(60%)	32(40%)	RC	
<b>Duration of work (Per day)</b>				
≤8	141(50.4%)	139(49.6%)	1.13(0.73-1.74)	0.59
>8	54(47.4%)	60(52.6%)	RC	
<b>Training</b>				
Apprenticeship	190(49.1%)	197(50.9%)	0.39(0.074-2.31)	0.24
Certified institute	5(71.4%)	2(28.6%)	RC	

COR: Crude odds ratio, RC- Reference Category, CI -Confidence Interval

**Table 5:** Factors associated with the practice of Personal Protective equipment

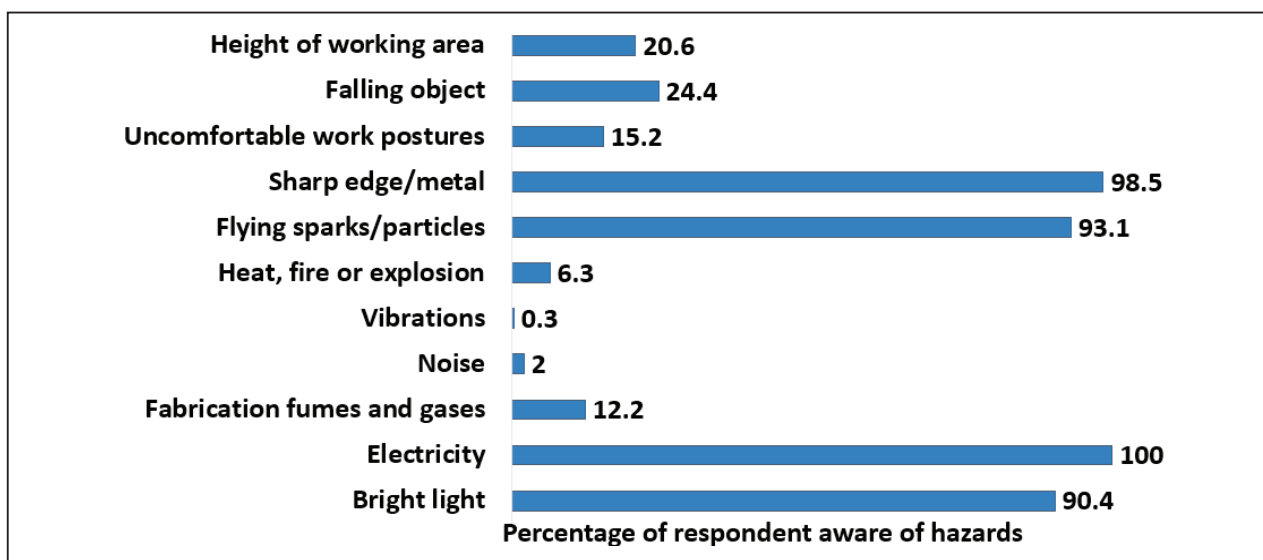
Characters	The practice of Personal Protective Equipment's		COR (95%CI)	AOR (95%CI)	p-value
	Good	Poor			
<b>Age in years</b>					
<25	91(82.7%)	19(17.3%)	RC	RC	0.09
25-34	109(90.8%)	11(9.2%)	2.06 (0.93-4.57)	1.59(0.59-4.29)	
35-44	105(89.7%)	12(10.3%)	1.82(0.84-3.96)	1.98(0.68-5.73)	
45-54	32(78%)	9(22%)	0.74(0.30-1.80)	0.55(0.16-1.92)	
≥55	6(100%)	-	-	-	
<b>Education level</b>					
Illiterate	2(66.7%)	1(33.3%)	RC	RC	0.14
Informal education	11(91.7%)	1(8.3%)	5.50(0.23-128.96)	3.31(0.01-672.16)	
Primary school	83(81.4%)	19(18.6%)	2.18(0.18-25.35)	0.31(0.003-32.28)	
Secondary school	183(87.6%)	26(12.4%)	3.51(0.30-40.18)	0.46(0.005-47.50)	
Higher secondary school	60(95.2%)	3(4.8%)	10.00(0.69-143.8)	1.17(0.01-142.03)	
Bachelor or more	4(80%)	1(29%)	2.00(0.07-51.59)	0.20(0.001-34.08)	
<b>Religion</b>					
Hindu	300(88.5%)	39(11.5%)	RC	RC	0.01
Buddhist	10(58.8%)	7(41.2%)	0.91(0.19-4.15)	0.30(0.06-1.47)	
Muslim	14(87.5%)	2(12.5%)	0.18(0.06-0.51)	0.52(0.10-2.55)	
Christian	14(87.5%)	2(12.5%)	0.91(0.19-4.15)	0.58(0.08-4.24)	
Others	5(83.3%)	1(16.7%)	0.65(0.07-5.70)	0.58(0.06-5.41)	

AOR: Adjusted Odds Ratio, COR: Crude odds ratio, RC- Reference Category, CI -Confidence Interval

**Table 6:** Knowledge and practice of Personal Protective equipment of the respondents

Knowledge	Practice		COR (95%CI)	AOR (95%CI)	p-value
	Good	Poor			
Poor	28(54.9%)	23(45.1%)	RC	RC	<0.001
Good	341(99.4%)	2(0.6%)	140.05(31.49-624.79)	150.24(29.76-758.46)	

AOR: Adjusted Odds Ratio, COR: Crude odds ratio, RC- Reference Category, CI -Confidence Interval



**Figure 1:** Awareness about the hazards of fabrication work (*Multiple responses*)

## Discussion

This study revealed that all the respondents were males. Females do not prefer this field of profession due to demanding physical workload and hazardous working environments. Likewise, there are few other studies done in Nepal, India, Pakistan, and Ethiopia that showed similar kind of gender bias in this occupation.<sup>12,14-16</sup> Due to this disparity the government needs to implement occupational health and safety strictly to generate employment for females in this field.

The majority of the respondents were aged between 25 and 34 years which is similar to a study conducted in Vellore of Southern India.<sup>17</sup> That may be due to the similar employment opportunity of the countries. Although, the majority of respondents were literate only half of them had schooling up to the secondary level (Grade 6-10) which explains the reason why most of them had poor working environment and less use of PPE. This matches a similar study done in Pakistan that had highlighted that the majority of workers were educated up to the primary level of education.<sup>15</sup> Thus with the similarity of these studies and the workers having limited education in this field of fabrication.

In the present study, the majority of respondents had work experience of fewer than five years and learned their work under the guidance of other experienced fabrication worker i.e. apprenticeships. The result is similar to other studies conducted in eastern Nepal (100%), India (87.7%), Pakistan (91.4%) and Nigeria (91.5%).<sup>12,14,15,18</sup> This may be to save the cost of vocational training and earn some money during the

apprenticeship and likely due to the poor financial condition of the fabrication workers. The higher turnover rate in this field of work could be due to lesser payment in other fields of work for similar education level. The fact that capital investment to start a low scale fabrication workshop is low and those who had moved out to the city in search of work on limited educational background, fabrication becomes a good option. Therefore, fabrication workers who were not trained regarding the use of safety measures and impending hazards at the workplace are at a higher risk of suffering from its hazards.

All the respondents in this study were found to have been injured in the last one year during fabrication works and the most common injury was burn (99.7%) followed by the cut injuries (99.5%). This is in contrast to the result in South coast India where abrasions and lacerations were most common and about half of the respondents had burn injuries.<sup>19</sup> This difference may be due to the workers do not take burns as a part of the work hazard and rarely use any preventive measures. They are negligent on the burn injury itself.

Out of the total fabrication workers, all of them had one or multiple complaints and the commonest was arc eye (85.76%). Arc eyes are painful inflammation of the cornea due to flash burn resulting in watery eyes, blurred vision and gritty sensation in the eye.<sup>20</sup> This result is similar to the studies conducted in Benin city of Nigerian where 75.7% of workers had arc eye, in Ethiopia (99.6%) and in south coastal India where the workers had 82.8% of flash burns.<sup>19,21,22</sup>

However, the study conducted in eastern Nepal showed a higher percentage of skin problems.<sup>13</sup> This variation in injuries may be due to the method of welding adopted there and depends on the use of protective measures by fabrication workers.

Amongst the potential hazards, electricity (100%) was the commonest hazard followed by sharp edge metal (98.5%), flying sparks (93.1%) and bright light (90.1%). But around one-fifth respondents considered noise, fabrication fumes and gases as potential hazards. These findings were similar to study from Ethiopia.<sup>16</sup>

However, a study from eastern Nepal revealed that bright light was the most frequent hazard encountered followed by welding fumes and gases. In another study conducted in Zambia revealed ergonomic hazards like lifting metals as the commonest hazard.<sup>12,23</sup> This variation regarding awareness of hazards is likely due to the different experiences of the fabrication workers and lack of knowledge on occupational health and their probable hazards.

Fabrication hazards like noise and vibration though irritating, health effects in exposed persons, are seen only after a long duration of exposure which might be the reason why the workers consider these potential causes as less hazardous by the workers.

On the contrary to this study, studies in Northern Nigeria and the Benin City of Nigeria showed 60.9% and 35.9% of workers respectively were found using safety goggles.<sup>18,22</sup> This difference of use of PPE may be due to the availability of protective gear and the knowledge about PPE in Nigerian fabrication workers than in Nepal. In Nepal, the use of sunglasses instead of safety goggles is probably because these are cheaper, easily available and are provided by the employer to their employees and the majority of them consider it as a protective gear. Some of the fabrication workers avoid the use of goggles due to poor visibility in the work stations and discomfort while using them.

In this study out of total respondents, 97.9% practiced the use of insulated gloves. The workers who use gloves daily was only 12.3%. The use of gloves was less because of discomfort on performing work by using insulated gloves and the use was higher in winter due to the need to touch cold metals.

Fabrication workers who had informal education had an 82% chance of having less awareness about

occupational hazards as compared to those who were educated up to bachelor or more. But the relationship is found to be not statistically significant ( $p=0.34$ ). In contrast to this, the study conducted in Northern Nigeria showed the level of education was significant with occupational hazards.<sup>24</sup> Similarly, the increase in education level was found to be significantly associated with awareness about occupational hazards in Lideta Sub-city, Addis Ababa, Ethiopia and eastern part of Nepal.<sup>12,21</sup>

In the present study, regarding occupational information of respondents, those who had better work experience were found to be more aware of occupational hazards compared to those with lesser work experience in fabrication work and the relationship is statistically significant ( $p=0.001$ ). Similarly, a cross-sectional study from eastern Nepal revealed that the work experience was associated with awareness about occupational hazards.<sup>12</sup> Other studies conducted in Ethiopia and Northern Nigeria also showed a similar result.<sup>18,21</sup>

The education level of respondents was not associated with practice about PPE. On the contrary, another study conducted in Ethiopia showed an association of education level with practice about PPE. It revealed that fabrication workers with certificate level education had 13 times more chance having good practice about PPE.<sup>16</sup>

In the current study, religion and practice about PPE depict that in comparison to Hindus, Buddhist and Christian fabrication workers had less practice about PPE and is statistically significant ( $p=0.01$ ). Though there is not any study that showed a relationship of practice about PPE with Religion, the use of PPE is higher in Hindu religion fabrication workers. The likely rationale being that the study conducted in the region had most Hindu respondents.

## Conclusion

About 86% of the respondents have occupational health effects within one year. All of the respondents were found to know about occupational hazards. Regarding PPE, 84% of fabrication workers practice PPE for at least one part of the body among six parts of the body during their work.

Although most fabrication workers were aware of the occupational hazards and PPE from experience, this has not been reciprocated in practice about PPE.

## Recommendation

Fabrication workers must have the institutional training and the facility licensing to strengthen knowledge regarding occupational health hazards and proper use of modern PPE. The employers must maintain a healthy occupational environment, provide suitable and comfortable PPE and make sure all the employees use them.

The government should enforce proper working guidelines including the minimum payment and PPE at the workplace. The government must assign a Labour Inspector who time to time inspects and report the status of the workplace, injuries, and accidents due to the occupation. The government must enlist all the unregistered workshops so that the proper database can be made for monitoring, implementing safety rules and cross-check institutes.

## Limitation

The study analyzes a limited sample of workers from a large urban area. So, a larger sample with geographical diversity is better to generalize the results. The result of the study is based on self-reporting regarding past one year injuries may present the recall bias. The study failed to explore the availability of PPE while performing their work

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