

CLINICAL RESEARCH

Unmasking Factors Associated with Personal Protective Equipment Use among Carpenters and Welders in Urban District in Uganda

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ABSTRACT

BACKGROUND

Use of Personal protective equipment is one of the measures to reduce occupational injuries. Carpentry and welding are associated with occupational hazards, in the process of performing these tasks, they suffer from work related injuries due to low or no use of personal protective equipment. Despite the known importance of workers using Personal Protective Equipment, there is limited documentation in Uganda. We therefore sought to assess the knowledge, attitude and practices towards the use of personal protective equipment among carpenters and welders in Seeta, Mukono district.

METHODS

A cross sectional descriptive was conducted among people engaged in welding and carpentry. We collected data using both quantitative and qualitative techniques. Systematic simple random sampling was conducted to identify the study participants. Using Kish Leslie's formula (Kish, 1959), we estimated the sample size of 152 respondents where 76 carpenters and 76 welders were interviewed. Four key informants were interviewed using key informant guide to understand the context of personal protective equipment use among the study participants. Quantitative data was collected using opened ended questionnaires and structured checklist embedded in android smartphones. For qualitative data, face to face interviews were conducted by the corresponding author. Quantitative data was entered in Epi-collect, cleaned and analyzed using STATA 13.0 and qualitative data was analyzed by conventional content analysis.

RESULTS

Majority of the participants 96.7% (147/152) were males and the mean age was 31.42. Most of the participants 99.3% (151/152) reported to have heard about personal protective equipment and all reported that Personal Protective Equipment offers them protection (99.3%). Majority used boots/shoes 39.86% (61/152) where they reported using it while doing any work 78.29% (119/152). Being a carpenter ($p = 0.001$) and never hearing about personal protective equipment ($p = 0.001$) were statistically significant to always using a personal protective equipment at workplaces.

CONCLUSION

Our study highlighted that participant had good knowledge on the need to use of personal protective equipment at their workplace although few were having good practices of using them. We recommend the district local government authorities while enforcing the occupational health regulation should increase awareness among welders and carpenters in bid to protect their health.

KEYWORD

Personal protective equipment use; Welders and carpenters; Uganda

INTRODUCTION

Uganda has been reported to have a high rate (60%) of non-use of personal protective equipment (PPE) hence increasing the risk of injuries at work [1]. In Uganda, the Occupational Health and Safety (OHS) Act Number 9 of 2006 requires all employers to provide a safe working environment besides safety measures to employees and employees to comply with safety measures in place [2]. A study conducted among welders in Jinja showed a PPE usage prevalence of 69% [3], compared to 100% recommended in the Uganda OHS Act. Employers are obliged by law to enforce occupational safety and health measures so as to protect their workers from harm. There is a heavier toll of occupational deaths and injuries since most works are involved in primary and extractive activities. The carpentry and welding are among vulnerable occupational groups due to deficient resources, limited finances, negligence and passive attitude of employees and employers towards the use of personal protective equipment. Majority of the workforce is employed in these businesses and yet they do not meet the minimum standards and guidelines set by the World Health Organization and the international Labor Organization for occupational health and safety [4].

Carpenters face their own unique set of occupational hazards which may include injuries from the use of various machinery and tools, cancer from formaldehyde in pressed wood and wood dust, performing repetitive tasks and lifting which leads to musculoskeletal pains, working outdoors with heat stress and risk of eye injury from flying particles [5]. The occupational hazards which welders get exposed to are ultraviolet and infrared radiation exposure, harmful metal fumes and particulate matter, thermal burns [6]. These hazards can be prevented through use of PPE which is a last resort when engineering and administrative controls are insufficient for controlling the hazards [7]. These include gloves, overalls, boots, face shields, head or neck coverings and many others. It is therefore the responsibility of the employer to assess the hazards and provide proper equipment and train employees appropriately according to Occupational Health Safety Act 2006 [8].

Due to scarce studies about use of PPE in Mukono, there is little or no knowledge on the use of personal protective equipment. The continued lack of information on carpenters' and welders' knowledge, attitudes and practices on use of PPE would lead to misdirected interventions to support PPE use. This would result into sustained high rates of occupational injuries and long-term effects such as noise induced hearing loss and occupational asthma which can be prevented by dutifully wearing PPE. This study therefore intended to explore the knowledge, attitude and practices of carpenters and welders on use of PPE. The information generated will benefit the district health team, local leaders, management, and employees so that they design evidence-based intervention to address the problem of low use of PPE.

METHODOLOGY

Study Setting

The study was conducted in Seeta, Mukono district (Figure 1). Mukono is a district located in Central Uganda with 13 sub-counties and 72 parishes. Seeta is a parish located in Goma sub-county. It is approximately 18 kilometers (11 mi) east from Kampala. Seeta is bordered by Kampala, Kira, Naggalama and Lugazi and constitutes of 11 villages. Mukono district has a population of 596,804 of which 91,768 is in Goma division [9].



Figure 1: Map of Uganda showing Seeta, Mukono District.

Study Population

The study population constituted both men and women above 18 years of age working in carpentry and welding workshops in Seeta, Mukono district. We defined welders as people involved in designing, making, cutting and joining of doors, windows and chairs using metallic compounds including iron and aluminum. Whereas the carpenters were defined as people involved in designing, making and selling of chairs, windows and doors from wood. Key informants included the leaders and managers of the workshops.

Sampling Size and Sampling Procedure

Using Kish-Leslie, 1965 formula, we estimated the sample size of 152 respondents who participated in the study and 4 key informants were selected from the parish. We selected two villages by purposive sampling which had the highest number of carpentry and welding workshops. In each village, 25 workshops were selected by systematic random sampling at an interval of four. Therefore, the 4th workshop on the left side of the street was the 1st one to be selected. Simple random sampling technique was used to select the participants at the workshop. For key informants, we purposely targeted the leaders of these workshops and we interviewed four of these from all the workshops.

Data Collection, Management and Analysis

Quantitative data

Quantitative data was collected by research assistants using open ended semi-structured questionnaire embedded in android smartphones and an observational checklist. The questionnaire was adopted from previous standard International labour Organisation guidelines [10]. We collected information on demographic characteristics and knowledge, attitude and practices towards the use of personal protective equipment among carpenters and welders. The questionnaire comprised 4 sections. Section one comprised questions on socio demographic characteristics, Section 2 questions on knowledge of PPE, section 3 questions on attitude and section 4 questions on practices with the use of PPE among carpenters and welders. The observational checklist was used to observe and confirm whether carpenters and welders were wearing PPE at the time of interview. For qualitative data, face to face interviews were conducted by the corresponding author using key informant guide (supplementary form 1).

Analysis

Quantitative data was analyzed using STATA version 13. Analysis was done at univariate and bivariate. At univariate level, all variables were analyzed to compute their frequencies, percentages, means and modes. Results were presented in form of tables. At bivariate level, crude Prevalence Ratios with a 95% confidence interval and 5% significant level were used as a measure of association at this level. For qualitative data, these were recorded using recorders on smart phones. The audios were then transcribed by trained and qualified research assistants. The transcripts were imported into Microsoft Excel and read several times to identify initial codes based on repeated and emerging issues. Conventional content analysis was used, where codes and categories arising from the data were used. Related codes that were identified from the data were manually grouped together to form three categories, which emerged into themes. These themes were presented as narrations.

RESULTS

Socio-Demographic Characteristics

Equal number of welders and carpenters each consisting of 50% (76/152). Majority 96.7% (147/152) were male, had ever received formal education 86.2% (131/152) and 13.8% (21/152) had informal education. Majority were aged between 18 years - 34 years with the mean age of 31.42 (Standard deviation 11.33). Most 56.58% (86/152) of the respondents reported that they had not received training on use of PPE. The mean period of working in the workshop was 12.02 years with a standard deviation of 9.18 years and median of 9 years (Table 1).

Table 1: Demographic characteristics of the participants.

Characteristics	Frequency (n = 152)	Percentage
Type of Work		
Carpenter	76	50.00
Welders	76	50.00
Age Categories		
18 – 24	49	32.24
25 – 34	49	32.24
35 – 44	29	19.08
45 or Older	25	16.45
Sex		
Male	147	96.71
Female	5	3.29
Religion		
Anglican	44	28.95
Catholic	38	25.00
Moslem	37	24.34
Born Again	25	16.45
Other	8	5.26
Marital Status		
Single	74	48.68
Married	78	51.32
Ever Attended Formal Education		
No	21	13.82
Yes	131	86.18
Highest Level of Education		
Primary	13	9.92
Ordinary Level	39	29.7
Advanced Level	32	24.43
University	24	18.32

We also found out that one third 33% (50/152) of the participants, received a training on occupational health and safety two years ago (figure 1).

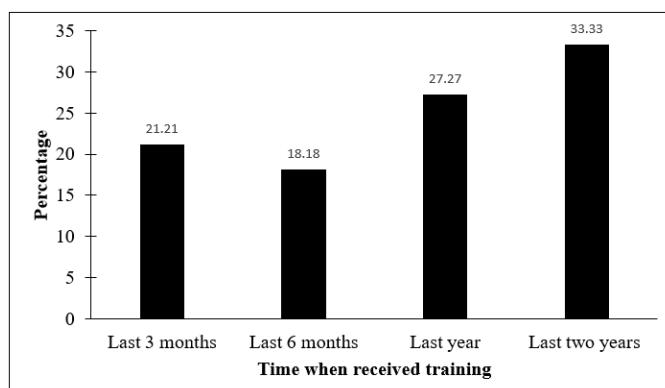


Figure 1: Time since they received their last training in occupational safety.

Knowledge

Most of the participants had ever heard about PPE 99.34% (151/152). Majority responded that it is necessary to use PPE 91.45% (139/152). All the participants knew that PPE protect one from injuries. Also, majority of the participants knew that their workplace posed a health risk 98.03% (149/152) and majority considered using a PPE depending on the work type 61.39% (93/152).

While quantitative results demonstrated high knowledge on use of PPE, the qualitative findings contradicted. Many of the key informants mentioned that the carpenters and welders do not know the importance of using of PPE. In line with this, one KI said;

“Few workers here know about the use of PPE but once I provide it, they wear because it provides protection.”
(Manager 2)

“They don’t know about PPE but they just wear because they don’t want to get injured.”
(Manager 3)

Table 2: Knowledge about PPEs use.

Description	Frequency (n = 152)	Percentage (%)
Heard about PPE		
Yes	151	99.34
No	1	0.66
Is it Always Necessary to Use PPE?		
Yes	139	91.45
No	13	8.55
The Use of PPE Protects one from Injuries		
Yes	152	100.00
No	0	0.00
Aware that their Workplace Poses a Health Risk		
Yes	149	98.03
No	3	1.97
What they Consider when using PPE		
Work Type	124	61.39
PPE Type	25	12.38
Hazard Presence	53	26.24

Attitude Toward the use of PPE

Majority of the participants responded that PPE make them comfortable 90.79% (138/152), offers them protection 99.34%(151/152) and they can use it without supervision. Although quantitative data demonstrate high positive attitude of carpenters and welders towards use of PPE, some KIs considered workers’ attitudes to be poor calling for supervision of workers in order to minimize injuries. They further mentioned that PPEs are always used by the carpenters and welders who are more experienced than the others because they know the risks they pose when the PPE is unavailable.

One KI mentioned; *“The attitude is poor; they need supervision, and they don’t care if PPE is present or not present. They also don’t like it because they don’t know about it.”*

(Manager 1)

Table 3: Attitudes towards the use of PPEs.

Description	Frequency (n=152)	Percentage
Do PPE Make you Comfortable		
Yes	138	90.79
No	14	9.21
Do you think PPE Offers Protection?		
Yes	151	99.34
No	1	0.66
Do you Feel the Necessity to Always Protect yourself at Work?		
Yes	151	99.34
No	1	0.66
How Effective do you Think PPE is in Terms of Injury Protection		
Very Effective	111	73.03
Effective	34	22.37
Moderately Effective	6	3.95
Not Effective	1	0.66
Can you Use PPE without Supervision?		
Yes	136	90.79
No	14	9.21
Reasons for Using PPE		
It Offers Protection	141	45.48
It is Available	90	29.03
It is a Requirement by Authority	55	17.74
Others Use it	24	7.74

Practices on the Use of PPE

All the participants reported that they use PPE, with majority using boots/shoes 39.86% (61/152), and majority using PPE when doing any work 78.29% (119/152). From observations, PPE were not always used, the carpenters and welders said it makes them uncomfortable. It was observed that they will wear PPE only when it's necessary and depending on the task they were performing at that time. Some of them, the PPE was not in proper working condition, but they still used it. In majority of the workshops, they did not have any safety signs (Table 4).

Table 4: Practices of PPE use.

Description	Frequency (n = 152)	Percentage
Do you Use PPE?		
Yes	151	100.00
No	0	0.00
Type of PPE Used		
Goggles	66	23.08
Gloves	41	14.34
Face Shield	54	18.88
Boots/Shoes	114	39.86
Ear Plugs or Earmuffs	11	3.85
Frequency of PPE Use		
When doing any Work	119	78.29
When Exposed to Dangerous Work	32	21.05
Only when Told to do so by Supervisor	1	0.66
Ever Gotten Injured while Using PPE		
Yes	77	50.66
No	75	49.34
Frequency of Changing their PPE		
When it Wears Out	123	49.60
When it is Provided	108	43.55
After Inspection by Authority	17	6.85
Never	0	0.00
Storage and Management of PPE		
Clean and Store after Usage	128	84.21
Leave Exposed at Workplace	11	7.24
Not Bothered	13	8.55
Who Encourages them to Wear PPE		
Self	119	78.29
Supervisor	18	11.84
Safety Officer/Authority	1	0.66
No body	14	9.21
Do you Request for PPE at Work		
Yes	90	59.21
No	62	40.79
What do you do if PPE is Torn or Lost		
Stop Work and Request for Another	55	36.18
Work and Request for Another	66	43.42
Wait for the Next Provision	27	17.76
Do Nothing	4	2.63

Table 5: Factors associated with knowing that it is necessary to always use PPE.

	Is it Necessary to Always Use PPE				p value	
	No		Yes			
	Frequency	Percent	Frequency	Percent		
Type of Work						
Carpenter	12	92.31	64	46.04	0.001	
Welders	1	7.69	75	53.96		
Age Categories						
18 - 24	4	30.77	45	32.37	0.212	
25 - 34	7	53.85	42	30.22		
35 - 44	2	15.38	27	19.42		
45 or older	0	0.00	25	17.99		
Sex						
Female	1	7.69	4	2.88	0.352	
Male	12	92.31	135	97.12		
Religion						
Anglican	2	15.38	42	30.22	0.109	
Born Again	4	30.77	21	15.11		
Catholic	6	46.15	32	23.02		
Moslem	1	7.69	36	25.90		
Other	0	0.00	8	5.76		
Marital Status						
Married	4	30.77	74	53.24	0.121	
Single	9	69.23	65	46.76		
Ever Attended Formal Education						
No	2	15.38	19	13.67	0.864	
Yes	11	84.62	120	86.33		
Heard about PPE						
No	1	7.69	0	0.00	0.001	
Yes	12	92.31	139	100.00		
Received training on PPE Use						
No	6	46.15	80	57.55	0.428	
Yes	7	53.85	59	42.45		
Aware that their Workplace Poses a Health Risk						
No	0	0.00	3	2.16	0.593	
Yes	13	100.00	136	97.84		
Do PPE make you Comfortable						
No	3	23.08	11	7.91	0.071	
Yes	10	79.92	128	92.09		

As far as quantitative findings confirmed moderate practices of carpenters and welders towards use of PPE, some KIs reported that carpenters and welders only wear PPE when they are exposed to dangerous tasks for a particular time and also when it's provided by the managers of the workshop. They highlighted that it is very important to focus on the organization of the working space and maintenance of the machinery used.

One KI mentioned; "*Yes, every day I inspect. It also depends on the orderly of the workplace since presence of nails or items are likely to injure people.*"

(Manager 4)

Factors Associated with Knowing that it is Necessary to always use PPE

On chi-square statistics, the type of work was associated with knowing that it is necessary to always use PPE (Table 5). Type of work (carpenter vs. welders) was the only factor associated with participants knowing whether it is always necessary to always use PPE.

DISCUSSION

Our study contributes to this area of occupational health and safety among small scale workers in Uganda who are always affected by injuries with limited medical insurances to them. We shade light on some of the issues behind underutilization of PPEs among the welders and carpenters in urban districts in Uganda. This business of welding and carpentry is a growing field and therefore increase utilization of PPEs is a great contribution to the success of this business and welfare of the workers.

Knowledge Assessment

Most of the participants had ever heard about PPE and majority responded that it is necessary to use PPE. This is consistent with the findings from other studies among carpenters and welders from settings outside of Uganda. A study reported that industrial workers in small scale enterprises were aware of both the types of PPE available in the workplace and the work-related eye hazards [11]. A study conducted among people who work in motor vehicle repair workshops in Saudi Arabia, reported a high knowledge level with regards in PPE use. It showed that 90.7% of employees correctly indicated that PPEs protect workers from injuries, prevent from diseases or condition and reduce or protect workers from contact with hazardous substances [12]. Similar findings of good knowledge about PPE use have been shown by studies among garment workers in Tamil Nadu, India. They reported that more than 50% of workers were aware of the benefits of PPE and there was a wide gap between knowledge level and practice [13]. A study done among chili growing farmers in Ubonrachathani Province, Thailand indicated a 77.2% of chili-growing farmers had low level of knowledge about personal protective equipment during pesticide application [14]. This is in agreement with [15] which revealed that 62% laborers had inadequate knowledge on occupational safety and health. It had a prevalence of occupational accidents (19.7%) within a year which was associated to the use of PPE and maximum participants (92.1%) heard about PPE. However, this contradicted from this study, which revealed that 91.32% heard about PPE and 98.03% were aware of the occupational risks at the workshop. There is need to design more reminders at the workshops to help the workers remember to use PPE.

From our study, minority had received training on PPE use with majority having had their training on PPE use two years ago (33.33%). All the participants knew that PPE protect one from injuries. Also, majority of the participants knew that their workplace posed a health risk and majority would consider using a PPE depending on the work type. This is in agreement with [16] where 90.6% of welders in southwestern Nigeria, were aware of existence of protective eye equipment. A cross-sectional analytic study to assess the level of knowledge, attitude and practice of PPE use was conducted amongst rattan craftsmen in Vietnam. The results showed that 78.2% had low knowledge about PPE, 18% had moderate knowledge while only 3.7% had a high knowledge [17]. This could be explained due to the fact these are informal setups with minimal administrative arrangements. This makes organizing such trainings hard but also the management pays such staff on daily basis and may not see the value of investing in keeping them safe. However, this also comes to our policies in country on such small-scale workers. There is need for urgent public health interventions in enforcing the occupational health and safety regulations. This will protect such workers and their families.

On chi-square statistics, the type of work was associated with knowing that it is necessary to always use PPE. Type of work (carpenter *vs.* welders) was the only factor associated with participants knowing whether it is always necessary to always use PPE. According to a study conducted in Uyo, Nigeria among auto technicians showed that high level of knowledge on PPE usage did not imply high utilization of PPE. Nevertheless, 80.8% of the respondents had good knowledge on PPE usage, and 78.8% reported receiving any form of training on workplace safety. This could imply that prior training on PPE usage could have a positive impact on PPE usage among the workers [18]. It is essential to note that the level of knowledge of PPE among carpenters and welders influences the use of PPE.

Attitude Towards the Use of PPE

Majority of the participants responded that PPE make them comfortable, offers them protection and they can use it without supervision. Attitude towards PPE influences the use of PPE, as wearing it is a type of behavior and attitude influences behavioral practices [19]. A study conducted about community football players' attitudes towards personal protective equipment in Australian football showed that almost three quarters of the players (73.6%) reported wearing mouth guards during the previous playing season (year 2000) compared with only 2.1% wearing headgear. The most common reasons for not wearing headgear and mouth guards (in non-users) were: "*I don't like wearing it*" (headgear: 44.8 %; mouth guards: 30.6%), and "*It is too uncomfortable*" (headgear: 40.7%; mouth guards: 45.8%) [19]. This illustrated a positive attitude towards mouth guards and a negative attitude towards headgears.

Unavailability and discomfort are negative attitudes towards the use of PPE which leads to sharing of equipment available amongst colleagues in a Jinja welders highlights improper use of PPE [3]. Absence in ventilation in helmets causing hair loss, fire resistant coats not fitting the person and delayed replacement of PPE was cited by steel workers in Visakhapatnam as reasons for not using PPE. Thus 97% had a positive attitude towards PPE usage [20]. A report on attitude and practices towards personal protective equipment usage in construction Industry showed that most workers were aware that rules existed to protect them from injuries. These were unsure of what exactly they were being protected from, and only little of all workers ever got PPE training [21]. In 2008, a cross-sectional analytic study to assess the level of knowledge, attitude and practice of PPE use was conducted amongst rattan craftsmen in Vietnam. The results showed that 42% had a positive attitude towards PPE, 69% had a neutral attitude and 26.8% had a negative attitude [17].

Practices on the Use of PPE

All the participants reported that they use PPEs, with majority using boots/shoes, and majority using them when doing any work. In a study among craftsmen in Vietnam, the majority of participants indicated a fair level of practice of PPE as opposed to a more than a good level of practice [17]. As study among garment workers in Tamil Nadu, India reported that more than 50% of workers were aware of the benefits of PPE and there was a wide gap between knowledge level and practice [13]. A study among small scale industries in Jinja, Uganda reported that the prevalence of regular usage of PPE was rated at 69%, though only 2.8% of them had proper welding goggles with only 12.8% of them having all the gear [3]. Nature of work environment and task duration also affect workers' decisions to use PPE. Dusty, greasy environments affect clarity of protective eyewear, with concerns of cleanliness and visibility through them [22]. Workers performing short tasks have reported limited use of PPE because they don't find it necessary [22,23] as compared to those that are involved in tasks taking a longer time. Another cross-sectional study employing stratified random sampling methods among garment workers in India found the level of PPE utilization to be 4%. It also showed mostly used PPE being gloves made of flexible metallic strings to protect their fingers from accidental cuts and injuries [13]. Use of PPE has been reported to cause discomfort and as such a physiological burden through increasing workers' core temperature causing heat stress [24].

Our study had a number of strengths for example, Firstly, this is the first study on PPE use to be conducted in this study area. We also used a wide range of data collection methods (questionnaires, checklists and key informants)

and this helped us to derive more detailed information of this subject. We also visited the workshops, and this gave us chance to probe further on particular aspects. A systematic simple random sampling was applied in selecting the study participants and this helped to minimize selection bias in our study. Both bivariate and logistic regression was done to establish the level of association among the factors we set out to study. Trained research assistants were employed to help in data collection. Lastly, we used a standard questionnaire as guided by the international labour organization which makes our study results valid for a wider community. Given that it was an academic project for the corresponding author for her undergraduate degree award, we also had limitations. First the sample size used was small due to minimal resources that were available to this study in this short time. Secondly, this study was conducted at the peak of global pandemic of COVID-19 where there was enforcement of PPEs among all workers and it's possible the observed PPEs like masks could have been done as a result of COVID-19 making our results overrepresented than the actual population. We also anticipate information bias where some participants did not respond truthfully. However, checks were included in the study tool, research assistants were thoroughly trained in data collection techniques including probing and assurance of confidentiality, and importance of study was emphasized.

CONCLUSION

Most of the participants had ever heard about PPE and majority responded that it was necessary to use PPE. All the participants knew that PPE protect one from injuries. Also, majority of the participants knew that their workplace posed a health risk and majority considered using a PPE depending on the work type. Being a carpenter and never heard of PPE were found to be statistically significant. We therefore targeted training for these welders and carpenters on the need to use PPE at workplaces. A robust study using a bigger sample size should be conducted across the country to help unearth more segments about PPE use among small scale traders in Uganda.

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COMPETING INTERESTS

The author declares no competing interests.

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