# **Original Research Article**

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# An assessment of the effect of health education on the use of personal protective equipment among small scale welders (panel beaters) in Akwa Ibom state, Nigeria

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### **ABSTRACT**

**Background:** Welding work serves as a means of livelihood for many Nigerians and welders are exposed to a variety of occupational hazards. In Nigeria, high rate of welding injuries has been reported to be due to low or non-use of PPE and this has been attributed to poor knowledge. Several studies have recommended education as a means of educating welders. The aim of the study is to determine the effect of health education intervention on PPE use among oxyacetylene welders.

**Methods:** This is an interventional study with a control. Data was collected using an interviewer administered questionnaire from respondents selected by simple random technique, and was repeated after 3 month after health education intervention. Data was analysed using SPSS version 20, Chi-square analysis was used to determine observed differences between both groups pre- and post-intervention.

**Results:** At pre- intervention, there were significant differences in the level of knowledge and use of some PPE between the two groups. The proportions of respondents that have knowledge of various types of PPE and used them was significantly higher in the intervention group (p<0.05). The frequency of used of PPE also increased. The main reason for non-use of PPEs were high cost and inconvenience.

**Conclusions:** Health education brought about a significant increase in awareness and use of PPE. Regular health education needs to be given to all cadres of workers in their workplaces on the use of PPE to reduce occupational related injuries.

Keywords: Health education, Personal protective equipment, Welder

#### **INTRODUCTION**

Welding is an ancient profession; it is a process of joining or cutting metal parts using flame or electric arc and other sources of heat. Welding can be dangerous and unhealthy if appropriate precautions are not taken. It is associated with a lot of hazards and has been ranked as a high risk occupation based on cost related injuries. <sup>1</sup> There are more than 80 different types of welding and associated processes<sup>2</sup> but the commonest types in Nigeria are gas and electric arc welding. <sup>2</sup>

Gas welding utilizes oxyacetylene flame while electric arc welding involves the use of electricity.<sup>3,4</sup> Welders

who use gas welding process in Nigeria are commonly called panel beaters and this study concentrates on this group of welders.<sup>5</sup>

Welders are exposed to a variety of occupational hazards with untoward health effects. Hazards associated with welding affects all organs of the body as reported in different studies from different states in Nigeria.

In order to minimize exposure and consequently the health risk, the World Health Organization (WHO)<sup>7</sup> and the ILO suggest the use of Personal Protective Equipment (PPE): overalls, gloves, goggles, and boots.<sup>8,9</sup> The high rate of injuries in Nigeria has been reported to be due to low or non-use of PPE as only a small percentages of welders were reported to use PPE when working. Safety standards which guide welding occupation are either lacking or not adhered to in most parts of the country. <sup>10,11</sup> There is therefore need for health and safety education programmes that focus on prevention of the hazards of welding, since awareness and attitude towards these hazards are important factors in their prevention.

It has been reported that most Nigerian workers learn knowledge and skills regarding safety from co-worker's and employers<sup>3</sup> which implies that most workers are not trained or educated on the health hazard associated with the jobs, how to manage the risk and use of personal protective equipment at the point of entry at work.<sup>3,12</sup>

Welders are often trained on the job and, may delay to seek medical intervention in the event of injury, or may generally adopt the poor practices and attitude of their trainers. Non-compliance with PPE use expose welders to welding hazards and PPE use amongst welders is reportedly low in different parts of the country. Reason commonly cited for low use of PPE are lack of felt need, ignorance and inconvenience caused by its use. 13-15

Welders are exposed to a variety of occupational hazards with untoward health effects and awareness of these hazards and the attitude towards them are important factors in the prevention of these hazards. Therefore, to minimize the economic loss and personal tragedies, priority should be given to prevention of occupational related injuries through education. 10

Several studies have been conducted in different parts of Nigeria and other countries to show the knowledge, health effect of welding and injuries sustained by welders and most have recommended health education as a means of reducing hazard and educating welders on the use of PPE but there is dearth of publications on studies on the effect of health education on behaviour change amongst welders in Nigeria. <sup>1,4,6,16,17</sup> There is also a dearth of published work on welders in Akwa Ibom State.

Occupational health services, especially health education, for workers in the state are non-existing and there is no

notification or registration system for occupational injuries for welders in the State Ministry of Health. Information from this study can be used by the Occupational Health Department in the State Ministry of Health as a baseline data to establish a notification/registration system for occupational injuries where injuries can be reported. It can also be utilized by government authorities to: formulate safety regulations and guidelines for the welding profession in the State; formulate safety education campaigns; formulate and execute comprehensive study with a view to structured and focused health care services for welding related diseases.

#### **METHODS**

The study was carried out in Akwa Ibom State. Akwa Ibom State is located in the coastal South-Southern part of Nigeria lying between latitudes 4° 32′ and 5° 53′ north, and longitudes 7° 25′ and 8° 25′ east. It has 31 local government areas (LGA); grouped in 3 Senatorial districts – Uyo, Ikot Ekpene and Eket senatorial districts. All LGAs were arranged in alphabetical order and represented by numbers and two LGAs were chosen by simple random sampling by balloting with replacement from all the LGAs in the State. The two LGAs selected are Uyo and Ikot Ekpene, they are 32km apart and about 40minutes drive and are intercepted by four LGAs namely;

The population of Uyo is 305,961, while Ikot Ekpene has a population of 141,408 according to the 2006 population Census. <sup>18</sup>

The state government is the major employer of labour, most people in Uyo are civil servants but a significant proportion engage in various small-scale businesses like farming, fishing, trading and artisanship among which is welding. In Ikot Ekpene, people are mostly farmers, craftsmen, traders and artisans.<sup>19</sup>

This was an interventional study with Uyo LGA serving as the intervention site, while Ikot Ekpene LGA was the control site.

There was no official listing of Panel Beaters in Uyo (Intervention LGA) and no officially recognized association. Consequently, information on panel beaters in Uyo could not be obtained from official sources. Panel beaters, by the nature of their trade were clustered around auto-mechanical workshops along major roads and the mechanic village (a specific area allocated by the government to mechanics and panel beaters). However, panel beaters were first identified using the snowball technique. They were met at their places of work and were informed about the study with an invitation to participate. Ninety seven (97) panel beaters were identified in the study area and constitute the sampling frame for this study. In Ikot Ekpene LGA (Control LGA), some panel beaters are members of the

Automobile Association of Ikot Ekpene. The Automobile Association consist of mechanic, spray painters, electricians, motor parts sellers and panel beaters. Fifty eight (58) panel beaters are registered under this association and all of them consented to the study, thirty four (34) other panel beater were located at various automechanical workshops along major roads in Ikot Ekpene LGAs giving using the snowball technique, a total of ninety two (92) panel beaters in the control LGA. The list generated through this process constituted the sampling frames for the intervention and control LGAs and participants were then selected by simple random sampling using computer generated random numbers. Eighty nine and eighty eight respondents were selected in the intervention and control group respectively.

It was an health education intervention study: the study had three phases; Phase one - Baseline information was obtained from both study groups; Phase two was the intervention phase where health education was given to panel beaters in Uyo and phase three was the post-intervention phase when the effect of the intervention was measured after 3 months and health education was thereafter given to panel beaters in Ikot Ekpene LGA for ethical reasons.

A pretested semi structured interviewer administered questionnaire containing both opened and closed ended question was pre-tested and validated among welders in Abak LGA, where it was administered to 15 panel beaters (10% of the sample size). A standardised questionnaire was not used for the study therefore pre-test was done to know if the respondents understood the questions/options. To know their responsiveness in order to identify phrases subject to misinterpretation, and time it took to answer the questions and complete each questionnaire. Corrections were then made to the questionnaire based on this.

In the pre-intervention stage, data collection was carried out among 177 respondents in both groups, at panel beaters workshop and mechanic village town hall with informed consent in both LGAs. The pre-tested semi structured interviewer-administered questionnaire sought for information on knowledge, attitude and practices concerning use of PPE and prevalence of welding related health conditions among the panel beaters. The respondents were interviewed individually.

The goal of the intervention stage was to increase the knowledge base of panel beaters, at every level, enabling them to make decisions that will result in increased utilization of PPE during welding procedures especially among those that can afford to buy the PPE. Panel beaters were educated on hazards of welding and the importance of PPE use. Health education was done in form of discussion, use of leaflet/posters and demonstrations. Four sessions of health education were held at the intervention phase for panel beaters and their apprentices. A designated hall within the Mechanic Village was used

for health education intervention for seventy one (71) respondents and two sessions were held. Two education sessions were held at two designated mechanic workshops for other fourteen (14) respondents. Each health education session lasted for three hours. Formal health education was preceded by question and answer sessions on hazards of welding, types of PPE, associated health problems and actions taken by the welders to resolve their health problems. The question and answer session which lasted about forty five minutes was aimed at identifying the gap in knowledge. Thereafter, health talk was delivered in Pidgin English and Ibibio language over two hours on welding hazards, wrong perceptions on welding, health seeking behaviours and PPE use. For clarity and better understanding, posters listing the hazards associated with welding and relevant PPE welders were distributed to the welders in addition to physical demonstration with different PPE like coverall, helmet, safety goggle, facemask, boot and gloves. After the demonstration, respondents were asked to redemonstrate.

The post-intervention stage was conducted three months after, using the same questionnaires used at baseline. In the control group, Health education was then administered variously at the Automobile Association House for registered members and at designated mechanic workshops for non-association members. This was for ethical reasons and benefit of the participants.

Before the commencement of the study ethical clearance was sought and obtained from Ethical and Review committee of Akwa Ibom State Ministry of Health.

## **RESULTS**

One hundred and seventy seven (177) questionnaires were administered to panel beaters, at the pre-intervention stage, 89 in the intervention group and 88 in control group. While 85 intervention respondents and 83 control respondents were available for the post intervention stage of the study giving a response rate of 93.4% and 94.3% for the intervention and control groups respectively and an attrition rate of 6.6% and 5.7% respectively. Two respondents in the intervention group practiced both oxyacetylene and arc welding process and as such were dropped from the analysis. Eighty three (83) respondents in both intervention and control groups respectively were therefore used for the study.

Table 1 shows that the level of knowledge on hazards associated with welding was similar at baseline for both groups, 43.4% intervention group and 53.0% control, but the intervention group had better knowledge of PPE (30.1%) than the control group (9.6%). At Post intervention, knowledge on hazard associated with welding and knowledge of PPE in the intervention group was significantly higher (81.9% and 57.8%) compared to the control group 62.7% and 7.2% respectively.

During the pre-intervention, no respondent had any knowledge of ear muff. Respondents in the intervention group were more aware of gloves (60.2%) and goggle (55.4%), while the control group were more aware of coverall (75.9%) as PPE. At the post intervention, the intervention group were more aware of all the PPE except facemask (10.8%) and ear muff (1.2%) (Table 2 and 3).

Table 4 shows the total of 70.5% of respondents (75.9% and 65.1% in the intervention and control group respectively) used at least one PPE. The use of PPE was similar in both groups, however more respondents, 34.9% in the intervention group used goggles (34.9%).

In Table 5 total of 73.5% of respondents (83.1% and 63.9% in the intervention and control group respectively) used at least one PPE post intervention. The use of PPE

was similar in both groups but respondents in the intervention group use more goggle (45.8%) and boots (42.2%) compared to the control group (20.4%) for Google & boots (24.1%).

A total of 67.5% of respondents (75.9% and 59.0% in the intervention and control group respectively) owned at least one PPE. Ownership of PPE was similar in both groups but more respondent in the intervention group owned goggle (33.7%). No respondent owned ear muff (0%) (Table 6).

No one owned earmuff in both group. A total of 70.5% of respondents (81.9% and 59.0% in the intervention and control group respectively) owned at least one PPE. There was difference in ownership of goggle and boots between the intervention and control group (Table 7).

Table 1: Knowledge distribution of respondents by categories (pre and post intervention) (n = 166).

Level of knowledge		Study status	Study status				
		Intervention n (%)	Control n (%)	Total n (%)	Test Statistics and Statistical values		
(1) Hazard	Poor (0-4)	47 (56.6)	39 (47.0)	86 (51.8)	$\chi^2 = 1.544$ ; DF = 1		
	Good (5-10)	36 (43.4)	44 (53.0)	80 (48.2)	P = 0.214; NS		
(1) <b>PPE</b>	Poor (0-3)	58 (69.9)	75 (90.4)	133 (80.1)	$\chi^2 = 10.931$ ; DF =1 P = 0.001**; 95% C.I. =		
	Good (4-7)	25 (30.1)	8 (9.6)	33 (19.9)	-0.509 to -0.134; S		
(2) Hazard	Poor (0-4)	15 (18.1)	31 (37.3)	46 (27.7)	$\chi^2 = 7.699$ ; DF = 1		
	Good (5-10)	68 (81.9)	52 (62.7)	120 (72.3)	P = 0.006**; S		
(2) PPE	Poor (0-3)	35 (42.2)	77 (92.8)	112 (67.5)	$\chi^2 = 48.417; DF = 1$		
	Good (4-7)	48 (57.8)	6 (7.2)	54 32.5)	P<0.0001;S		

(1)= Pre-intervention; (2) = Post-intervention.

Table 2: Awareness of welding PPE by respondents pre-intervention (n = 166).

PPE	Study status n (%) positive res	Test statistics and statistical values		
FFE	Intervention Control n (%) n (%)		Total n (%)	statistical values
Goggle	46 (55.4)	20 (24.1)	66 (39.8)	$\chi^2$ =17.002; DF =1 p<0.001**; S
Gloves	50 (60.2)	36 (43.4)	86 (51.8)	$\chi^2 = 4.729$ ; DF =1 p = 0.030**; S
Boots	49 (59.0)	55 (66.3)	104 (62.7)	$\chi^2 = 0.927$ ; DF =1 p = 0.336; NS
Helmet	19 (22.9)	12 (14.5)	31 (18.7)	$\chi^2$ 1.944; DF =1 p = 0.163; NS
Coverall	51 (61.4)	63 (75.9)	114 (68.7)	$\chi^2$ 4.032; DF =1 p = 0.045**; S
Facemask	9 (10.8)	5 (6.0)	14 (8.4)	$\chi^2 = 1.248$ ; DF =1 p =0.264; NS
Ear muff	0 (0.0)	0 (0.0)	0 (0.0)	

S= statistically significant.

Table 3: Awareness of welding PPE by respondents post-intervention (n = 166).

PPE	Study status n (%) positive res	sponses only	Test statistics & statistical	
	Intervention n (%)	Control n (%)	Total (%)	value
Goggle	71 (85.5)	19 (22.9)	90 (54.2)	$\chi^2 = 65.623$ ; p<0.001** DF = 1; S
Gloves	49 (59.0)	32 (38.6)	81 (48.8)	$\chi^2$ =6.968; p = 0.008** DF = 1; S
Boots	63 (75.9)	52 (62.7)	115 (69.3)	$\chi^2 = 3.425$ ; p = 0.064 DF = 1; NS
Helmet	29 (34.9)	10 (12.0)	39 (23.5)	$\chi^2 = 12.099$ ; p = 0.001** DF = 1; S
Coverall	75 (90.4)	58 (69.9)	133 (80.2)	$\chi^2 = 10.931$ ; p = 0.001** DF = 1; S
Facemask	9 (10.8)	9 (10.8)	18 (10.8)	$\chi^2 = 0.000$ ; p = 1.000 DF = 1; NS
Ear muff	1(1.2)	1(1.2)	2 (1.2)	Fishers exact=1.000

Table 4: Distribution of types of PPE used by respondents pre-intervention (n = 166).

PPE	Study status n (%) positive responses only		Total	Test statistics and statistical
LLF	Intervention n (%)	Control n (%)	n (%)	values
Goggle	29 (34.9)	16 (19.3)	45 (27.1)	$\chi^2 = 5.152$ ; P = 0.023**; DF = 1; S
Gloves	23 (27.7)	17 (20.5)	40 (24.1)	$\chi^2 = 1.186$ ; P = 0.276; DF = 1; NS
Boots	27 (32.5)	20 (24.1)	47 (28.3)	$\chi^2 = 1.454$ ; P = 0.228; DF = 1; NS
Helmet	8 (9.6)	10 (12.0)	18 (10.8)	$\chi^2 = 0.249$ ; P = 0.618; DF = 1; NS
Coverall	28 (33.7)	31 (37.3)	59 (35.5)	$\chi^2 = 0.237$ ; P = 0.627; DF = 1; NS
Facemask	3 (3.6)	2 (2.4)	5 (3.0)	Fishers exact= 1.000
Ear muff	0 (0.0)	0 (0.0)	0 (0.0)	

<sup>\* =</sup> Fishers exact Test, S= statistically significant.

**Table 5: Types of PPE used by respondents post-intervention (n = 166).** 

PPE	Study status n (%) positive responses only			Test statistics and statistical
TIL	Intervention n (%)	Control N (%)	Total n (%)	value
Goggle	38 (45.8)	17 (20.4)	55 (33.1)	$\chi^2 = 11.991$ ; p = 0.001**; DF = 1; S
Gloves	28 (33.7)	17 (20.5)	45 (27.1)	$\chi^2 = 3.689$ ; p = 0.055 DF = 1; NS
Boots	35 (42.2)	20 (24.1)	55 (33.2)	$\chi^2 = 6.118$ ; p = 0.013** DF = 1; S
Helmet	12 (14.5)	10 (12.0)	22 (13.3)	$\chi^2 = 0.210$ ; p = 0.647 DF = 1; NS
Coverall	31 (37.3)	29 (34.9)	60 (36.1)	$\chi^2 = 0.104$ ; p = 0.747 DF = 1; NS
Facemask	3 (3.6)	2 (2.4)	5 (3)	Fishers exact= 1.000

Table 6: Welding PPE owned by the respondents pre-intervention (n = 166).

PPE	Study status n (%) positive responses only		<b>Total</b>	Test Statistics and statistical
	Intervention n (%)	Control n (%)	n (%)	values
Goggle	28 (33.7)	9 (10.8)	37 (22.3)	$\chi^2 = 12.555$ ; DF = 1; p<0.001**; S
Gloves	22 (26.5)	14 (16.9)	36 (21.7)	$\chi^2 = 2.270$ ; DF =1; p = 0.132; NS
Boots	29 (34.9)	20 (24.1)	49 (29.5)	$\chi^2 = 2.345$ ; DF =1; p = 0.126; NS
Helmet	4 (4.8)	3 (3.6)	7 (4.2)	Fishers exact = $1.000$
Coverall	29 (34.9)	31 (37.3)	60 (36.1)	$\chi^2$ = 0.104; DF =1; p =0.747; NS
Facemask	2 (2.4)	2 (2.4)	4 (2.4)	Fishers exact = $1.000$

<sup>\* =</sup> Fishers exact test, S= statistically significant.

Table 7: Welding PPE owned by respondents post-intervention (n = 166).

PPE	Study status n (%) positive res	ponses only	Test statistics and	
FFL	Intervention n (%)	Control n (%)	Total n (%)	statistical values
Goggle	38 (45.8)	9 (10.8)	47 (28.3)	$\chi^2 = 24.961$ ; p<0.001**; DF = 1; S
Gloves	26 (31.3)	15 (18.1)	41 (24.7)	$\chi^2$ = 3.919; p=0.048; DF = 1; NS
Boots	36 (43.4)	20 (24.0)	56 (33.7)	$\chi^2 = 6.899$ ; p=0.009** DF = 1; S
Helmet	5 (6.0)	3 (3.6)	8 (4.8)	Fishers exact= 0.720
Coverall	42 (50.6)	30 (36.1)	72 (43.4)	$\chi^2 = 3.532$ ; p=0.060 DF = 1; NS
Facemask	3 (3.6)	3 (3.6)	6 (3.6)	Fishers exact= 1.000

<sup>\* =</sup> Fishers exact Test; DF = Degree of freedom,; S= Statistically significant; NS= Not statistically significant.

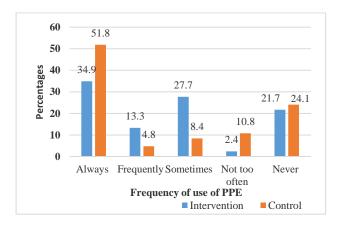


Figure 1: Frequency of use of PPE by respondents' pre-intervention (n = 166).

Frequency of use of PPE by respondents' pre-Intervention. More respondent in the control group 51.8% use PPE always while 21.7% in the intervention group never use PPE (Figure 1).

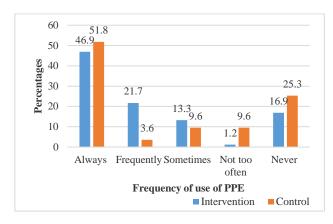


Figure 2: Frequency of use of PPE by respondents' post-intervention (n=166).

Frequency of use of PPE by respondents, Post intervention 46.9% in the intervention group use PPE always and 16.9% never use PPE (Figure 2).

Reason for non-use of PPE by respondents preintervention. Common reasons stated for no-use include cost, unavailability and comfort (Figure 3).

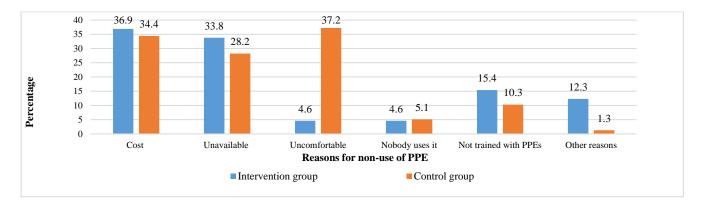


Figure 3: Reason for non-use of PPE by respondents pre-intervention (n = 166).

#### **DISCUSSION**

The study showed a significant level of general awareness of PPE by the respondents. Majority (94%) of the respondents were aware of at least one PPE. The most popular PPE known to the respondents were protective coverall (68.7%), safety boots (62.7%), gloves (51.8%) and safety goggles (39.8%). This was higher than results obtained in a study in Benin where knowledge of coverall and safety goggles were measured at 31.2% and 35.9% respectively.<sup>3</sup> However, knowledge of other specific PPE was poor. Face mask and helmet were the least known by respondents. Ear Muff was not known at all by the respondents as a protective tool against noise whereas 35.5% of them identified noise as a welding hazard. A trend can be established between respondents' knowledge of specific PPE, their knowledge of hazards and commonly experienced health challenges by welders in the study areas. The high incidence of cuts and injuries (after back pains) correlates positively to the high knowledge of protective coverall, safety boots and gloves and a 79.5% awareness of fire, heat and burns as welding hazards. The uneven and poor distribution of knowledge on all PPE does not reflect formal orientation or training on PPE. It is highly deductible that awareness of hazards and commonly experienced health problems are significant contributing factors to respondents' awareness of relevant PPE. For instance, only 39.8% of respondents in the study and control groups were aware of welding goggle as a means of protection to the eye and this is comparable to a study in Benin (39%).<sup>3</sup> This may be due to poor knowledge of ocular hazards of welding. The use of ordinary eyeglasses equally may be a manifestation of this ignorance. In this study 6% of respondent use sunglasses which is not a recommended PPE. This finding is similar to finding in a study in Limpopo where 6% of the welders use sunglasses.<sup>20</sup>

Another factor for high awareness of gloves, boot and coverall may be the fact that these PPE are not welding specific as most other artisans in the study areas use gloves, coverall and boots. These PPE are very common with Oil Field Service workers in Akwa Ibom State.

This study showed that 94% of the respondents were aware that PPE use can prevent work related injuries. However, only 67.5% reported ownership of one PPE or the other while 70.5% confirmed having used at least one PPE before. Broken down into specific PPE ownership and use, a general poor picture was thrown up. The highest percentage ownership of a single PPE was 36.1% (coverall) with the lowest ownership of 2.4% (Face Mask). There was 0% ownership of ear muffs. On the other hand, the highest and lowest percentage usage were recorded on coverall (35.5%) and face mask (3.0%). Just over a third of the respondents (34.9%) in the intervention group and half (51.8%) of respondent in the control group, reported consistent use of PPE. These do not reflect a 94% PPE awareness level among the welders. This is consistent with what several studies have shown that even when the benefits of PPE use is known, compliance to PPE use remains poor. The relatively high level of awareness of PPE does not translate to the adoption of safety measures. 4,10,13-15

The major reason for non-use of PPE in this study were high cost; non-availability; long years of experience; inconvenience; prevalent culture of non-use among welders at both locations; ignorance and or wrong attitude; and lack of orientation during apprenticeship. Similar reasons were given in a study in Owo where ignorance and perceived lack of need were the main reasons for non-use, and Ile Ife where non-use was attributed to discomfort. Aside high cost of PPE, all the other reasons for non-use in a nutshell reflect deep

rooted ignorance on the consequences of non-use and high risk tolerance among the welders. High cost of PPE alone does not form a good reason for non-ownership and use of PPE. Viewed against the income levels of the welders, it is arguable that with the right orientation and training, the cost of acquiring a PPE should not be a deterrent when compared to the benefits of using them.

The study also revealed that the commonly used PPE were coverall (35.5%), gloves (24.1%), boots (28.3%), and goggles (27.1%). A striking observation here was the positive relationship between ownership and use of PPE. It is equally noteworthy that in some cases, usage levels outstrip ownership of specific PPE. Welders without PPE borrow from others who are not using them at that time. It thus appears that availability of PPE encourages their use. This equally aligns with the trend in respondents' awareness of hazards and PPE ownership. It appears that awareness of welding associated hazards drives ownership of relevant PPE which in turn facilitate use.

This study showed that health education can have a positive impact on welders' knowledge on hazards, knowledge of PPE, PPE ownership/use and other health seeking behaviour of welders in the study areas. Health education intervention significantly increased the level of knowledge of hazard associated with welding and knowledge of PPE, there was slight increase in ownership and use of PPE among welders.

Post intervention, there was an increase in awareness of PPE in the intervention group, this results demonstrate that health education intervention can actually improve welders' knowledge of relevant PPE. Same may not be said in improvement in ownership and use of PPE even with the improved awareness of hazards. This may largely be due to the cost implication of acquiring new PPE. The proportion of respondents who use sunglasses in the intervention group also increased post-intervention because they were found cheaper than welding goggles. Other contributing factors may be grounded poor perceptions and attitudes that will take some time to change, and availability. The moderate improvement recorded in the control group on hazards knowledge may come about from self-help learning by the welders after interaction with the researcher.

The limitation of this study was the limited observation period. The length of time variously spent with the welders, in the opinion of the author, was not adequate to independently validate the claims of the welders on actual use, types of PPEs employed, and attitudes to use, of PPEs. The author had to significantly rely on the responses of the welders to questions on knowledge, use of, frequency of use and attitudes to PPEs. To reduce this bias, the author employed the 'show me' approach to validate claims of knowledge, ownership and use of PPEs. This approach however could not validate claims on the frequency of use and other attitudinal questions.

#### CONCLUSION

Health education brought about a significant increase in awareness and use of PPE. Regular health education needs to be given to all cadres of workers in their workplaces on the use of PPE to reduce occupational related injuries.

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