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Common Health Challenges in Welding Workshops in Orodo, Mbaitoli L.G.A, Imo State Nigeria

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ABSTRACT

This study investigated common health challenges in welding workshops in Orodo. This study aims to determine the use of personal protective equipment among welders, and levels of awareness of occupational hazards and complaints among welders. The descriptive cross- sectional research design was adopted for the study of a population of 400 welders in Orodo from an official source. A sample size of 400 welders, drawn using a proportionate random sampling technique took part in the study. Cronbach Alpha Coefficient test was used for the reliability of the instrument and a reliability of 0.86 was got. The data collected were analyzed using percentages to answer the research questions whereas figures and Chi-square was used to test the hypotheses. The findings of the study showed that the level of knowledge about occupational hazards of the welders was relatively high in the categories. The findings also revealed that there were significant differences in knowledge of occupational hazards among the welders based on age, work experience, and level of education at $p<0.50$ respectively. It was recommended, among others, that there should be increased involvement of healthcare providers in the provision of safety devices and knowledge dissemination to the welders in Orodo.

KEYWORDS: *Welding, Health challenges, Welding Workshops, Health, Welder*

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INTRODUCTION

Workplace is an important part of human environment. The health and efficiency of workers in any organization get influenced in large extent by conditions in their work environment. It is an established fact that no occupation is without risk of hazard. There are varieties of health hazards in the occupational environment to which workers can be exposed and which may cause various diseases. These are related to physical condition such as temperature, humidity, noise, light, chemical agents in the form of vapors, fumes, droplets, gases; and unsafe and unprotected machines and technical equipments responsible for causing accidents.

According to WHO (2005), there are about 250 million cases of work-related health challenges per year worldwide. One of the jobs that contribute to these occupational health challenges is the welding process, especially in developing countries. Electric welding joins pieces of metal that have been made liquid by heat produced as electricity passes from one electrical conductor to another (Howden, *et al 1988*). Temperatures above 4000oC in the arc heat both the base metal pieces to be joined and a filler metal coming from a consumable electrode wire that is continuously fed into the weld. Most of the materials in the welding fume come from the consumable electrode, which is partially volatilized in the welding process; a small fraction of the fume is derived from spattered particles and the molten welding pool (Palmer and Eaton, 2001). The electrode coating, shielding gases, fluxes, base metal, and paint or surface coatings also contribute to the composition of the welding aerosol. Components of the source materials may be modified, either thermo chemically in the welding zone or by photochemical processes driven by ultraviolet light emitted during welding.

Vaporized metals react with air, producing metal oxides that condense and form fume consisting of particles that are primarily of inhalable size. The composition and the rate of generation of welding fumes are characteristic of the various welding processes and are affected by the welding current, shielding gases, and the technique and skill of the welder. The concentration of the fume in the welder's vicinity is also a function of the volume of the space in which the welding is performed and the efficiency of fume removal by ventilation (Beckett, *et al 1996*). The particle size distribution of welding fumes is an important factor in determining the hazard potential of the fumes because it is an indication of the depth to which the particles may penetrate into the lungs and the number of particles retained therein. Studies on welding fume have shown the particles to be < 0.50 pm in aerodynamic diameter (Jamuszkiewicz *et al,* 1966; Akselsson, *et al* 1976; Villaume, *et al* 1979), giving them a high probability of being deposited in the respiratory bronchioles and alveoli of the lungs where rapid clearance by the muco ciliary system is not effective. They Morphologic characterizations of welding fume have shown that many of the individual particles are in the ultrafine size range (0.01 to 10 pm) and had aggregated together in the air to form longer chains of primary particles (Clapp and Owen, 1977).

Welding is common indispensable procedure in engineering works and is associated with varied health hazards. Some of the hazards of this occupation include ultraviolet (UV) and infrared (IR) radiation exposure, fumes and particulate generation, thermal bums, occupational heat stress, exposure to electromagnetic fields, and electrocution. Similarly, the excessive lighting (glare) and exposure to UV radiation may lead to [4]arc eye' or 'flash bum' injuries to the cornea, photo-keratitis and double vision and consequent retinal damage. Welders are also exposed to noxious metal fumes, depending upon process and material containing a concoction of metals like zinc, copper, cobalt, nickel, chromium, platinum, and their oxides leading to various respiratory dysfunctions and influenza-like condition called metal fume fever. Metal fume fever is characterized by chills, thirst, fever, muscle ache, chest soreness, coughing, wheezing, fatigue, nausea and a metallic taste in the mouth. Other short term effects include irritation to eyes, nose, throat, chest and respiratory tract; gastrointestinal symptoms nausea, vomiting and cramps. Studies of welders, flame cutters, and burners have shown that welders have an increased risk of lung cancer, and, possibly cancer of the larynx and urinary tract on chronic exposure to the fumes.

The health risks associated with welding gases and fumes are also determined by the length of time one is exposed to them, type of welding engaged in, the work environment and the protection employed. Hence, it is pertinent to keep exposure to harmful gases and fumes below recommended Occupational Exposure Limits (OELs) and for limited duration to curb ill effects on health.

MATERIALS

Study Area

This study was carried out in Orodo Mbaitoli Local Government Area of Imo State. The study will be conducted at Orodo in Mbaitoli Local Government Area of Imo State. Orodo is an Igbo community in Mbaitoli local government area of Imo State, Nigeria. It is situated between Owerri city and Orlu town. Orodo has boarder with Ogwa, Mbieri, Afara, Ifakala, Umuaka, Amurie Omanze and Amandugba. Also, the current Mbaitoli Local Government Headquarters is significantly located at a part of Orodo called Ofekata.

Traditionally, Orodo is made up of the following 9 (nine) villages namely: Ahaba, Amaku, Amaukwu, Eziama, Odummara, Ofekata, Okwu-Orodo, Ubaha and Umuonyahu.

Population of the Study

The total population of the study area amounts to 381,200 according to 2006 census. But for a better understanding, the study employ a total of two hundred and fifty welders were mobilized for the study, with their ages ranging from 30 to 70 years; 80% males and 20% female. These welders came from different socio-cultural, socio-economic, and educational backgrounds. Most of these welders are found to be male arc welders working in towns located within Orodo in Mbaitoli local government area, who were exposed to welding fume

Instruments for Data Collection

The instrument for data collection was a structured questionnaire. One hundred and forty-two welding workers were recruited for the study (n=142). The lists of the welders were obtained from the chairman of the welders' association in each town. The welders were sampled proportionately from each town based on the number of registered members, and a computer-generated simple random scheme was used to pick the subjects.

The question items for section three and five were structured in a 4-point Likert scale format thus:

Strongly Agree (SA)	=	4 points
Agree (A)	=	3 points
Disagree (D)	=	2 points
Strongly Disagree (SD)	=	1 point

Similarly, the question items for section two and four were structured in a yes/no format. Where Y = Yes and N = No.

Research Design

A proportionate random sampling technique was used for the study. Heinrich (2012) described proportional random sampling as being useful for studying a variety of problems involving data collection for either testing hypotheses or answering pertinent research questions concerning the present status of subjects under study. He further stated that this design permits the description of conditions as they exist in their natural settings. Howden et.al, (2008) asserted that a proportionate random sampling technique covers the physical characteristics of people, behavior as well as their knowledge, attitudes, beliefs and opinions and practices that occurred or are occurring in the population.

The cross-sectional design therefore was considered most appropriate for the present study as it has effectively been utilized in related studies by Howden et.al (2008). The successful application of the design by the aforementioned investigators in their respective studies suggests a possible success in its use for the present study.

Administration of the Instruments and Field Work

The welders were met at their respective workshops in Orodo, where the essence and procedure of the study was explained to them. This boosted their interest and participation, especially as their identities would not be revealed. However, while some will comply others will not; each maybe afraid to be examined first.

A multi-stage technique was used in sampling of welder's workshop for the study from the divisions. At the first stage, one community was randomly selected from each division through balloting. Systematic random sampling was then used in the selection of 400 welder's workshops from which the study participants were drawn. Sampling started from community Centre of each towns in Orodo and workshops were selected at intervals of two workshops. This process went round the community until the required sample size for each selected community was reached.

Additionally, at occasion non-workshop eligibility, the next workshop was selected. The next stage was the selection of eligibility participants were those who were resident in the area for the past 1 year, above 18 years of age and may either be the boss or apprentice. Prior to data collection, the members of the selected communities were gathered at each head of the welder's workshop for sensitization exercise concerning the survey to be performed at their workshops and the need for their support. The appointment to that effect was scheduled in agreement with the welders and community leaders who also helped to mobilize the members of their respective communities.

Data Collection

The returned questionnaires will be properly cross-checked for adequacy of information. Copies that do not have adequate responses will be discarded. Data collection processes lasted for 3 months. Data was collected by administering structured pretested questionnaires to the study participants by members of the study group. For the selected participants, the study was once more introduced and informed consent was sought for their participation in the study. For those who gave their consent, the questionnaire was then elicited in the local (Igbo) language. The workshops were also inspected for the presence and provision of up-to-date safety equipment such as fire extinguishers. Data collected was analyzed using descriptive statistical methods. Frequency distribution tables were generated for all data collected.

Data Analysis

The method of data analysis was descriptive; Data collected was presented in tables of frequency distribution and were expressed as the percentage of the distribution. Findings were illustrated as tables, bar charts and pie charts where appropriate. Data collected from various sources were first arranged, classified and tabulated. This enabled the use of weighted mean in the discussion of the data. Consequently, hypotheses one and three were tested using the t-test statistical technique since it centers on a "yes" or "no" answer.

The hypothesis two was tested using Analysis of variance (ANOVA) statistical technique because it centers on the 4-point likert scale format. Both tests were carried out at 5% level of significance. The decision rule for both tests is such that

If the t-calculated or the F-calculated is greater than the t-table or F-table value at 5% level of significance, we reject the null hypothesis (H0) and accept the alternative (HA).

Furthermore, the Pearson Product Moment Correlation (PPMC) coefficient was used to test the degree of correlation or relationship between the causes, preventive measures and challenges in welding workshops. For the correlation analyses, the decision is as follows:

- 0.00 – 0.20 = very low relationship,
- 0.21 – 0.40 = low relationship,
- 0.41 – 0.60 = moderate/fair relationship,
- 0.61 – 0.80 = high relationship and
- 0.81 – 1.00 = very high relationship.

RESULTS

Socio-Demographic Data of Respondents

The Table 4.1 and Fig. 1 above shows that there are more male respondents than female respondents. There are 339 males representing 78% of the total sample size while females are 61 representing 22% of the sample size.

Table 4.1: Gender of Respondents

S/N	Gender	No. of Respondents	Percentage
1.	Male	339	78%
2.	Female	61	22%
	Total	**400**	**100%**

Source: Field survey, 2023

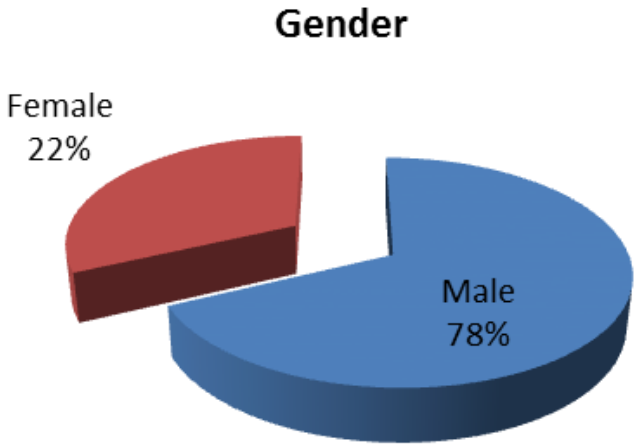

Fig. 1: Gender of the Respondents

The Table 4.2 and Fig. 2 above show that most of the respondents fall within the age bracket of 21-25 years representing 45% of the total sample. The other respondents (35%) fall within 16-20 years bracket while 13% and 8% of the respondents fall within the age bracket of 26-30 years and 31-35 years respectively. None of the respondents were 40 years and above.

Table 4.2: Age Distribution of Respondents

S/N	Age Bracket	No. of Respondents	Percentage
1.	16 – 20 years	141	35%
2.	21 – 25 years	187	45%
3.	26 – 30 years	45	13%
4.	31 – 35 years	27	8%
5.	40 and above	0	0%
	Total	**400**	**100%**

Source: Field survey, 2023

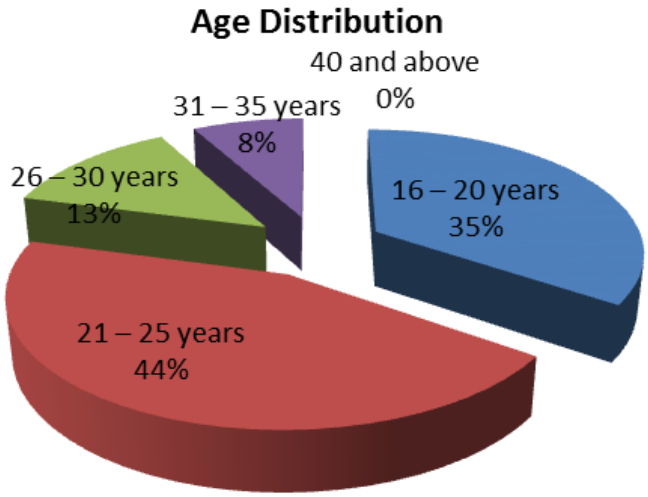

Fig. 2: Age Distribution of the Respondents

It can be seen from the Table 4.3 and the pie chart in Fig. 3 above that 43% of the respondents have at least secondary school education. 30% have primary school education while only 11% are graduates of a tertiary institution or still a student in a tertiary institution. However, 16% of the respondents have no form of formal education.

Table 4.3: Level of Education of Respondents

S/N	Educational level	No. of Respondents	Percentage
1.	None	55	16%
2.	Primary School	126	30%
3.	Secondary School	179	43%
4.	Tertiary/University	40	11%
5.	**Total**	**400**	**100%**

Source: Field survey, 2023

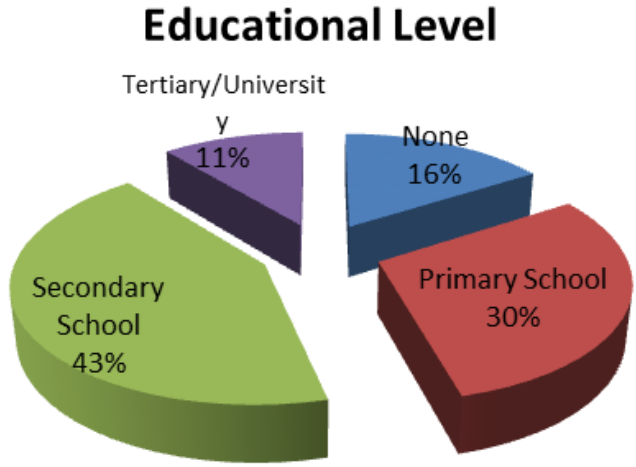

Fig. 3: Distribution of Educational Level of the Respondents

Research Question One: What are the personal protective equipments used by welders in Orodo?

Table 4 shows the use of personal protective equipment among welders. Six (4.4%) of them use a helmet always when working, four (2.8%) use it strongly agree, and three (2.1%) rarely use a helmet when working. Fourteen (9.8%) of them make use of a respirator always while three (2.1%) rarely use it

when welding. Ten (7.0%) of them use safety boots always, four (2.8%) use them strongly agree, and six (4.2%) disagree do. One hundred and thirteen (79.6%) of welders in our study use eye goggles always, 15 (10.6%), and five (3.5%) use them occasionally and rarely, respectively. Twelve welders (8.4%) use an apron always, while four (2.8%) use it both occasionally and rarely respectively. Only one (0.7%) of the welders use earplugs always and rarely and 13 (49.1%) use welding gloves always, while nine (6.3%) and eleven (7.7%) of welders use them strongly agree and disagree, respectively.

Table 4: Use of personal protective equipment among welders (n=142).

Variable	Agree	Strongly Agree	Disagree	Strongly Disagree
Use of Helmet	6 (4.2%)	4 (2.8%)	3 (2.1%)	129 (90.8%)
Respirator	14 (9.8%)	0 (0.0%)	3 (2.1%)	125 (88.0%)
Safety booth	10 (7.0%)	4 (2.8%)	6 (4.2%)	122 (85.9%)
Eye goggle	113 (79.6%)	15 (10.6%)	5 (3.5%)	9 (6.3%)
Apron	12 (8.4%)	4 (2.8%)	4 (2.8%)	122 (85.9%)
Ear muff	1 (0.7%)	0 (0.0%)	1 (0.7%)	140 (98.6%)
Welding gloves	13(9.1%)	9(6.3%)	11(7.7%)	109(76.7%)

Source: Field survey, 2023

Question Two. What are Levels of Awareness of Occupational Hazards and Complaints among the Welders?

Table 5 shows that 694 (91.6%) of the welders were aware of one or more workplace hazard while a total of 731 (96.4%) had experienced one or more work-related health problem. The most common complaints were arc eye injuries (75.7%); foreign bodies in the eyes (70.0%); back/waist pain (52.1%); metal fume fever (43.8%) and cut/injuries to the hands and fingers (37.7%). Comparisons between the levels of awareness of occupational hazards with the occurrence of health complaints were all statistically significant, ($p< 0.05$).

Table 4.5 Awareness of Occupational Hazards and Complaints among the Welders

Occupational Health hazard	Agree	Strongly Agree	Disagree	Strongly Disagree
'Arc eye' injury	683 (90.1)	574 (75.7)	55.3	0.000
Foreign body in eye	689 (90.9)	566 (74.8)	70.0	0.000
Breathlessness	210 (27.7)	116 (15.3)	34.5	0.000
Metal fume fever	198 (26.1)	73 (9.6)	70.2	0.000
Cuts/injuries from sharp metals	128 (16.9)	23 (3.0)	81.1	0.000
Burns	665 (87.7)	395 (52.1)	228.6	0.000
Electric shock	572 (75.5)	138 (18.2)	498.9	0.000
Explosion Back/waist pain	21 (2.8)	41 (5.4)	6.7	0.009
Impaired hearing	67 (8.8)	29 (3.8)	16.1	0.000

Source: Field survey, 2023

Test of hypotheses

Hypothesis 1: There is no significant relationship between age and knowledge of occupational hazards among welders in Orodo

Table 6: Chi-square test showing the relationship between age and knowledge of occupational hazards among welders in Orodo

Age	Knowledge of hazards Good F (%)	Poor F (%)	Total	df	Σ^2-value	p-value	Decision
<18 years	50(100)	0(0.00)	50(100)	3	104.83	0.00*	Ho rejected
18-27 years	255(100)	0(0.00)	255(100)				
28-37 years	205(82.3)	44(17.7)	249(100)				
>37 years	256(100)	0(0.00)	256(100)				
Total	766(94.6)	44(5.4)	810(100)				

***Significant; p<0.05**

Table 6 showed the Chi-square test of the significant relationship between age and knowledge of occupational hazards. The result showed that there was a significant relationship between the two variables (Σ^2-value = 104.83, df = 3, $p<0.05$). Thus, the null hypothesis which stated that there was no significant relationship between age and knowledge of occupational hazards among welders in Orodo was rejected.

Hypothesis 2: There is no significant relationship between years of work experience and knowledge of occupational hazards among welders in Orodo

Table 7: Chi-square test showing the relationship between years of work experience and knowledge of occupational hazards among welders in Orodo

Years of work experience	Knowledge of hazards Good F(%)	Poor F(%)	Total	df	Σ^2-value	p-value	Decision
<5 years	153(100)	0(0.00)	153(100)	3	59.63	0.00*	Ho rejected
5-10 years	311(87.6)	44(12.4)	355(100)				
11-15 years	233(100)	0(0.00)	233(100)				
>15 years	69(100)	0(0.00)	69(100)				
Total	766(94.6)	44(5.4)	810(100)				

***Significant; p<0.05**

Table 7 showed the chi-square test of the significant relationship between years of work experience and knowledge of occupational hazards. The result showed that there was a significant relationship between the two variables (Σ^2-value = 59.63, df = 3, p<0.05). Thus, the null hypothesis which stated that there was no significant relationship between years of work experience and knowledge of occupational hazards among welders in Orodo was rejected.

Hypothesis 3: There is no significant relationship between the level of education and knowledge of occupational hazards among welders in Orodo.

Table 8: Chi-square test showing a significant relationship between the level of education and knowledgeof occupational hazards among welders in Orodo

Level of education	Knowledge of hazards Good F(%)	Poor F(%)	Total	df	Σ^2-value	p-value	Decision
No education	2(100)	0(0.00)	2(100)	2	7.39	0.025	Ho rejected
Primary	109(100)	0(0.00)	109(100)				
Tertiary	655(93.7)	44(6.3)	699(100)				
Total	766(94.6)	44(5.4)	810(100)				

***Significant; p<0.05**

Table 8 showed the chi-square test of the significant relationship between the level of education and knowledge of occupational hazards. The result showed that there was a significant relationship between the two variables (Σ^2-value = 7.39, df = 2, p<0.05). Thus, the null hypothesis which stated that there was no significant relationship between the level of education and knowledge of occupational hazards among welders in Orodo was rejected.

Discussion of Findings

Level of knowledge of occupational hazards among the welders based on age

The result of Chi-square test of significant relationship between age and knowledge of occupational hazards indicated that there was a significant relationship between the two variables (Σ^2-value = 104.83, df = 3, p<0.05). Thus, the null hypothesis which stated that there was no significant relationship between age and knowledge of occupational hazards among welders in Orodo was rejected in all categories of age group except for the age group of 28-37 years. All the respondents (100%), those aged <18 years, 18-27 years and > 37 years had high knowledge about occupational hazards, the decisions are based on the percentage levels. As a result, knowledge of occupational hazards was found more among younger welders than older ones. The findings of this study suggest that age is not a true determinant of occupational hazard awareness. Although, this perception differs withsomebody's life pattern, is the person an introvert or an extrovert which may correspond with the live interactions?The findings of this study corroborate with the findings of Aadesse et al. (2016) whose study on occupational hazards and associated factors among welders showed that there was a significant difference in occupational hazards awareness based on age. Furthermore, this study's findings support Tagurum *et al.* (2018) who found that there was no significant relationship between age group and occupational hazards awareness among welders at p<6.05. The findings of this study are in line with the findings of Lavanya and Priya (2018) on knowledge regarding occupational hazards and safety measures among automobile workers who revealed that there was a statistically significant difference between occupational hazards awareness levels among the workers and the age group. The higher the age group was the higher the awareness of the occupational hazards they exhibited. The findings also support those of Chukwu *et al.* (2019) who discovered that there was a statistically significant difference

between the age of the welders and their awareness of hazards (Σ^2 – 131.905, p-value = (2.001). Odhiambo *et al.* (2020) confirmed this study as they showed that there was a significant difference between the number of years of a welder and the knowledge of hazards in their workplace, (p = 0.05). On the contrary, Kumar*et al.* (2013). Posited that age group was significantly associated in a univariate analysis. Also, the findings of Wokocha (2020) differ from the present study when they reported that there was a significant positive relationship between occupational hazards awareness and age.

Level of knowledge about occupational hazards of welders based on years of work experience

The result of the Chi-square test of a significant relationship between years of work experience and knowledge ofoccupational hazards revealed that there was a significant relationship between the two variables (Σ^2-value = 59.63, df = 3, p<0.05). Thus, the null hypothesis which stated that there was no significant relationship between years of work experience and knowledge of occupational hazards among welders in Orodo was rejected. Those welders who had worked for 5 years, 11-15 years and > 15 years (100%) had higher knowledge about occupational hazards than those who had 11-15 years of work experience. Thus, knowledge of occupational hazards was found more among welders who had worked for more years, the decision is based on their percentage levels. This findingimplies that the greater the years of work experience, the greater the improvement in awareness of hazards in workplaces. The findings relate to the theory of positivism in social medicine which was interpreted by Alderson (1998) to mean that in relationships between cause and effect, intrinsic variables in the worker or welder are considered in the analysis before solutions are made. Hence the welders' awareness of hazards may increase in course of hazards impacts encountered through their years at work. The findings of this study support the findingsof Eze *et al.* (2015) who showed that there was a significant difference between the work experience of welders and their occupational hazards awareness at (p<0.05). The same support goes to the findings of Lavanya and Priya (2018) who reported that there was a statistically significant difference between work experience and occupational hazards awareness among welders. The same support goes to Odhiambo *et al*. (2020) and Osagiede *et al.* (2010) at p=0.588. However, there was a significant statistical association between welders' work experience and occupational hazards awareness in the findings of Chukwu et al. (2019) and Gebrezgiabher *et al*. (2019) at (Σ2=145.366, p-value=0.001) and (AOR, 044) respectively.

Level of knowledge of occupational hazards among the welders based on level of education

The result of the Chi-square test of a significant relationship between the level of education and knowledge of occupational hazards showed that there was a significant relationship between the two variables (Σ^2-value = 7.39, df = 2, p<0.05). Thus, the null hypothesis, which stated that there was no significant relationship between the levelof education and knowledge of occupational hazards among welders in Orodo, was rejected. The findings exhibited that level of education has some positive impact to make in creating awareness of a welder. The higher the education level, the greater the awareness level. Little wonder why Nwafor *et al*. (2019) declared that the first step in protecting the workers is through education and training which involves the provision of information about the hazards of this occupation and then controlling the hazards through an engineering approach. They suggested that workers in Orodo should be given proper education and training on workplace hazards. These findings complement the findings of Tagurum *et al.* (2018) which showed that there was a significant difference between awareness of hazards among the welders based on level of education. Lavanya and Priya (2018) are also supportedby the findings of this study as they showed that there was a statistically significant difference found between occupational hazards awareness and level of education. Their findings are also congruent with the findings of Osagiede *et al.* (2020). Their findings differ from the findings of Kumar *et al.* (2013) which revealed that there was a significant association between awareness of occupational hazards and level of education among the welders in a univariate analysis. The findings of this study also disagree with the findings of Budhathoki *et al.* (2014) which showcased that there was a positive association between the level of education and awareness of occupational hazards among welders in Eastern Nepal. The findings of his study also contradict the findings of Aadesse *et al.* (2016) and Chukwu *et al.* (2019) which showed significant harmony between occupational hazards awareness of welders based on their education levels.

Conclusion

Based on the results of this study, it was concluded as an overview that knowledge of occupational hazards among the welders in Orodo was high in all the categories of socio-demographic determinants. Although knowledgeof occupational hazards among them increased chronologically based on the increase in the level of work experience. Overall, the result showed that there was a significant relationship between knowledge of occupational hazards and age,

work experience and level of education among the welders.

Recommendations

Based on the results of the study, the following recommendations were made:

1. Generally, healthcare workers and educators should intensify campaign programmes in the urban, city and rural areas on workers' health and safety practices.
2. Government and concerned agencies should visit these welders and share informative fliers and pamphlets on safety rules and policies to follow at work, with decoding of the implications of exposureto hazards.
3. Part of healthcare delivery provisions in the budget of the state should include the purchase and free distribution of basic safety wears to this group of most dangerous professionals called welders in Orodo.
4. Radio and Television Workers' Associations should promote regular special English and Native language programmes on safety practices and hazard awareness.

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