Awareness of Occupational Health Hazards and related problems Among Welders in Sharkia Governorate

Heba Galal Salah [(1)], Salwa Abbas Ali [(2)], and Samia Farouk Mahmoud [(3)]

[(1)] Demonstrator of Community Health Nursing, Faculty of Nursing, Zagazig University, [(2)] Professor of Community Health Nursing, Faculty of Nursing, Zagazig University, & [(3)] Assistant Professor of Community Health Nursing, Faculty of Nursing, Zagazig University, Egypt.

Abstract

Background: Occupational hazards are a globally major cause of disability and mortality among working population. Welding is industrial process in which welders are exposed to many hazards and problems during their welding process. **Aim of the study:** was to assess awareness of occupational health hazards and related problems among welders in Sharkia Governorate. **Subjects & Methods: Research Design:** A descriptive cross- sectional design was used. **Setting:** This study carried out at Al'Ashir Min Ramadan City in Sharkia Governorate. **Subject:** One hundred welders were selected from nine steel industries. **Tools of data collection tools: Two tools** were an interviewing questionnaire to assess demographic characteristics, work related data, occupational health hazard and problems, and awareness about various occupational hazard and related problems. **Results:** The highest hazardous exposures and related its problems was physical (100%) followed by mechanical (99% & 98%) respectively, chemical (92%), and psychological (81%). Moreover, overall exposure to hazards and related problems was (74% & 76%) respectively. Additionally, 47% of welders had high awareness of occupational hazards and related problems. **Conclusion:** All studied welders exposed to occupational health hazards and related problems. As well, overall exposure to hazards was high among less than three quarters of study sample. While, the total problems due to exposures was high among more than three quarters of study sample. Furthermore, less than half of welders had high awareness. **Recommendations:** Heath Education and training programs should be carried out regularly for educating welders about occupational health hazards and related problems, and further studies in other steel industries to detect magnitude of occupational health hazards and related problems.

Key words: Awareness, Occupational Health hazard, Problems, Welder, Sharkia Governorate.

Introduction:

Welding is a fabrication process whereby two or more parts are fused through heat, pressure, or both. Additionally, welding is a common industrial process as two percent of the working population in industrialized countries has been engaged in some sort of welding [(1)]. As well, welding is one of the most common joining processes in the metal industry, applied in facilities from job shop outfits to highly-automated computer-controlled industries [(2)].

The International Labor Organization (ILO), the World Health Organization (WHO) and United Nations (UN) have reported that there are 270 million workers suffer from occupational health hazards, and 2 million die as a result of these risks[(3)]. Also, according to (ILO), one worker loses their life because of work-related accidents and illnesses in the world every 15 second [(4)]. Similarly, in Egypt there are about 24,000,000 workers estimates at 26.5% from whole populations, those workers involved in various types of industries constitute a considerable portion of the population, each type of industry involves specific health hazards and the health of workers affects productivity and consequently the family and the country [(5)].

Occupational hazards have an enormous negative impact on the health of welders and their performance. They are exposed to many hazards during their welding process. They are exposed to physical, chemical, psychological, and mechanical hazards [(1)]. In the context physical hazards cause physical damage or injury, as noise, vibration, radiation, or excesses of heat, cold, electric shock and trauma. Furthermore, chemical hazards refer to the deleterious effects the chemical component of welding materials that welders are exposed to daily [(6)] as dust and fumes, when inhaled regularly over long periods, can result in serious effects of the welder's health [(7)].

Moreover, mechanical hazards caused by carrying heavy objects, standing, bending and sit for long period, fall and slips, sudden

movement. Mechanical hazards cause damage such as varicose veins, back pain, fractures, and neck pain, torn with ligaments [8].

A psychological hazard affects the mental health of the worker by overwhelming individual coping mechanisms and impacting the worker's ability to work in a healthy and safe manner [9] such as a lack of social support, respect and recognition from managers, lack of help from co-workers, lack of positive evaluation or feedback on their work, poor wages, shift work, early or late working times, and time pressure [10].

Welding is associated with an acute and chronic health effects as exposure to high levels of noise (>90dB) for eight hours or more is likely to cause noise-induced hearing loss [6]. Electric shock from welding and cutting equipment can result in death or severe burns. Additionally, serious injury can occur if the welder falls as a result of the shock [7].

Welders are much more likely to be suffering from respiratory problems that can cause serious and very often deadly pneumonia, occupational asthma; the welding gases are listed worldwide as carcinogenic to welders and metal fume fever. Morbidity of metal fume fever was 43.7% of welding workers and show symptoms like malaise, chills, dry cough, and shortness of breath, and finally, skin related problems, as reported symptoms of skin irritation and erythema [11].

Welders have a high prevalence of musculoskeletal complaints, including back injuries, shoulder pain, tendinitis, reduced muscle strength, carpal tunnel syndrome, white finger, and knee joint diseases. Work postures (especially welding overhead, vibration, and heavy lifting) can all contribute to these disorders. These problems can be prevented by proper lifting, not working in one position for long periods of time, keeping the work at a comfortable height, using a foot rest when standing for long periods, locating tools and materials conveniently, and minimizing vibration [12].

Lack of awareness about health hazards of welding and the importance of personal protective equipment. As well, lack of prevention and control measures to reduce the risk of hazards makes worse conditions of work for the welders [1]. Therefore, proper safety measures should be observed to ensure welders are protected from occupational hazards associated with welding process [13]. Moreover, the use of appropriate PPE can be an effective measure to protect the health of workers [14].

Occupational Health Nurse (OHN) serves communities in a variety of positions, as leader, educator, advocate and researchers, all in addition to nursing roles, occupational health nurse help the welders stay healthy by assisting with the development, promotion and management of welders' health. Moreover, health education program help welders reduce disease, improve quality of life and enable more welders to live healthier lives. Also, OHN collaborate with local health departments and other organizations provide health education, work on disease prevention initiatives, and coordinate efforts [15].

Significance of the study:

Welders constitute a substantial segment of a frequently overlooked demographic exposed to occupational hazard. Presently, there is a dearth of health impact and morbidity data related to the occupational hazards faced by welders. Additionally, limited studies have been conducted in Sharkia Governorate concerning occupational health hazards and associated issues among welders, as evidenced by available statistics (13). Consequently, it is anticipated that welders in this region are at risk of occupational health hazards due to exposure to fumes, gases, and burns during the welding process. This study aims to bridge this gap by offering a comprehensive understanding of the specific hazards faced by welders in Sharkia Governorate.

Aim of the study:

The aim of the study was assess awareness of occupational health hazards and related problems among welders in Sharkia Governorate.

Research Questions:

- What are the occupational health hazards & problems among welders in Sharkia Governorate?
- What is the level of awareness regarding occupational health hazards & problems among welders in Sharkia Governorate?

Subjects & Methods

Research Design:

A cross-sectional descriptive design was used to conduct the current study.

Setting:

The existing study was conducted at nine steel industries. These were namely the Kama Manufacturing, Arab Steel Fabrication El-Sewedy, Energya Steel Fabrication El-Sewedy, Abd-Elhamid for engineering, Elzaabalawy Complex for Decorative Iron, Linda Tube Manufacturing and Metal Processing, Metal Tube for Manufacturing Light, Arab valves, and Gest Metals in Al' Ashir Min Ramadan City.

Subjects:

The ongoing study has enlisted 100 welders, selected from the aforementioned settings.

Sample size:

Assuming the frequency of good knowledge about PPE was 33.3% vs 66.7% in those with work duration 1 year vs >6 years. At 80% power and 95 % CI. The estimated sample was 80 subjects.

Sampling Technique:

A multistage random sampling approach was employed for the selection of welders, outlined in the following stages:

1. First Stage (Selection of District): The study took place in Sharkia Governorate, comprising 23 districts. Utilizing a simple random sampling technique, the investigator randomly chose Al-Ashir min Ramadan District.

2. Second Stage (Selection of Industries): Al-Ashir min Ramadan District hosts 50 steel industries specializing in welding. The investigator randomly selected nine industries by drawing names from a jar. These selected industries constituted the study setting.

3. Third Stage (Selection of Welders): A systematic random sampling technique was utilized to recruit welders for the study. The Occupational Safety and Health Manager of each industry provided an ordered list containing the names of all welders. The investigator followed these steps:

The total number of welders across all nine steel industries during data collection was 399. A random starting point was chosen (two). Every fourth welder from the list was selected until the sample size was achieved. If a selected welder was unavailable due to illness, vacation, or any other reason, another name was chosen using the same pattern.

The selected industries and the number of welders sampled from each were as follows:

- Kama Manufacturing Industry (6 welders out of 30).
- Arab Steel Fabrication El-Sewedy (16 out of 70 welders).
- Energya Steel Fabrication El-Sewedy (21 out of 85 welders).
- Abd-Elhamid for Engineering Industry (13 out of 50 welders).
- Elzaabalawy Complex for Decorative Iron (18 out of 70 welders).
- Linda Tube Manufacturing and Metal Processing (8 out of 30 welders).
- Metal Tube for Manufacturing Light Industry (12 out of 46 welders).
- Arab Valves Industry (4 out of 12 welders).
- Gest Metals Company (2 out of 6 welders).

Tools of data collection:

Two tools were employed for the current study, namely: **Tool I:** An interview questionnaire developed by the researchers in alignment with the current related literature, comprising five parts.

- **Part (I):** This involved questions concerning the demographic data of the welders such as; code number, age, educational level, marital status, income, residence, number of family member and number of rooms.
- **Part (II):** This part asking about work related data such as; job, age at start, years of experience in welding , daily working hours, have breaks, weekly working days, work shift, work night shift, work double shifts, work overtime. Furthermore this part ask about welding job characteristics as, trained in welding, type of training, duration of training, welding type, gas type, weld tanks, weld

painted surfaces, body position at work, and profession license and reasons for not having.

▪ **Part (III):** Welders occupational health hazards and problems questionnaire. It was developed by the researchers and guided by **Abd Alaleem et al.** [9] and **Joshi et al.** [16] this included questions about welding is believed a hazard to health, previous exposure to occupational accidents as types, frequency, severity, needed hospital etc. Furthermore, assessing the types of occupational hazards and problems as physical, chemical, mechanical, and psychological hazards exposures and their problems experienced by welders in the previous 12 months period.

Scoring system:

Exposure to occupational hazards/problems: For each type of exposure hazard or problem, the respondent was considered as exposed if at least one of its items was checked as "exposed." For the total of exposure to hazards or problems, those exposed to 60% or more of the exposure types were considered as highly exposed and the total score was between **(0 to 90)**.

▪ **Part (IV):** This section inquires about the causes of occupational hazards and explores the perceived importance of factors contributing to these hazards. This includes aspects such as lack of supervision, laxity in the application of preventive measures, unavailability of PPE, non-utilization of PPE, lack of training on PPE usage, poor quality of PPE, inadequate lighting and ventilation, unavailability of safety and prevention instructions, lack of awareness regarding occupational hazards, and insufficient experience, skills, or training. Additionally, it delves into the consequences of exposure to occupational hazards, encompassing poor productivity, job dissatisfaction, frequent absenteeism, psychological problems, and family-related issues.

Scoring system:

Perception of importance factors underlying hazards/problems: The items checked as "not important", "important" and "very important" were scored from 0 to 2. The scores of the items were summed-up and the total converted into a percent score. The perception was considered "high" if the percent score was 60% or more, and low if less than 60% and the total score was between **(0 to 16)**.

▪ **Part (V):** This section inquires about perceptions regarding preventive measures, including commitment to using PPE, ensuring good ventilation, conducting welding in an open area, disconnecting all electrical connections and electrodes, keeping gas cylinders away from heat, maintaining order and cleanliness in the workplace, providing first aid, having a fire extinguisher present in the workplace, and enforcing a no-smoking and no-eating policy in the workplace.

Scoring system:

Perception of preventive measures: Each item checked was scored 1 and the unchecked scored 0. The scores of the items were summed-up and the total converted into a percent score. The perception was considered "high" if the percent score was 60% or more, and low if less than 60% and the total score was between **(0 to 63)**.

Tool II: This set of questions focuses on assessing the awareness of welders regarding various occupational hazards and associated problems. Developed by the researchers and guided by Gebrezgiabher et al. (17), this section includes inquiries about awareness related to physical, chemical, accidents, mechanical, and psychological hazards, along with their associated problems.

Scoring system:

Awareness: For each type of exposure hazard/problem, the respondent was considered as aware if at least one of its items was checked as "aware." For the total awareness of hazards or problems, those who reported to be aware of 60% or more of the exposure types was considered as highly aware and the total score was between **(0 to 63)**.

Pilot study:

The pilot study was carried out on 10 welders representing about 10% of the calculated total sample size. It was aimed at testing the adequacy of the research instruments, assessing whether the research protocol is realistic and workable, clarity of the questions, the format of the questionnaire,

comprehensiveness of the items and to estimate the exact time required for filling out the questionnaire form. According to the results of the pilot, all modifications of items were performed according to the pilot results, and the tools were finalized accordingly. The welders who shared in the pilot study were not included in the main study sample.

Field Work:

Following the acquisition of all necessary official permissions, the data collection process commenced in June 2022 and extended through November 2022. Initially, the researchers sought permission from the directors of the selected industries by meeting with the director of the labor office and the director of the occupational safety and health office of Al' Ashir min Ramadan.

Additionally, individual meetings were conducted with each Occupational Safety and Health Manager of the aforementioned industries. Subsequently, accompanied by the occupational safety and health managers, the researchers conducted a comprehensive tour of each selected industry to gain insights into the nature of the work. A collaborative schedule for data collection was then established with the director of each industry. Prior to the formal data collection, the researchers spent time with welders to familiarize themselves with the work environment.

During individual meetings, the study's aim and procedures were explained to the welders, who were then invited to participate. Those providing oral consent were interviewed using the two data collection tools, with each welder requiring approximately 25 to 35 minutes completing the forms. Additionally, observational checklists were completed by the researchers within a timeframe of 20 to 25 minutes. The fieldwork was conducted three days a week, specifically on Saturdays, Tuesdays, and Thursdays. All activities took place at the workplaces (welder industries), involving 4-5 welders per day.

Validity and Reliability:

It was ascertained by a panel of five experts in the field of community health nursing and community medicine, two professors from the Departments of Community Health Nursing and Geriatric Nursing, Faculty of Nursing, Zagazig University. As well as, three professors from faculty of medicine from the Department of Community Medicine and occupational health and safety who reviewed the contents of the tools for clarity, relevance, comprehensiveness and understandability.

The tools were modified according to their comments and suggestions. Cronbach's Alpha was used to conduct the reliability test, and the tools appeared to be reliable, where, Welders awareness of occupational hazard and problems questionnaire was (r =0.782), and Welders occupational health hazard and problems questionnaire (r = 0.943), which indicated high internal consistency.

Ethical consideration and Administrative design:

The research protocol received approval from the Research and Ethical Committee of the Faculty of Nursing, Zagazig University. Prior to commencement, the researchers clearly communicated the aim and objectives of the study to the welders included in the research. Oral consent was obtained from each welder before their inclusion, with a straightforward and comprehensible explanation tailored to their level of understanding. The researchers assured the welders that all collected data would be treated confidentially and used solely for research purposes. Anonymity and confidentiality of the subjects' data were diligently maintained throughout the study.

Welders were informed of their right to choose whether or not to participate in the study and had the freedom to withdraw at any point. Official permission was secured from the Workforce and Migration Directorate in Sharkia Governorate, facilitated by a letter from the Postgraduates Department at the Faculty of Nursing, Zagazig University, detailing the study's aim and procedures. Subsequently, approval letters from the director of the labor office and the director of the occupational safety and health office of Al' Ashir min Ramadan were obtained. The researchers, armed with approval letters, met with the directors of the selected industries, providing them with copies of the research tool and the formal letters, while explaining the study's objectives.

Statistical design:

Data entry and statistical analysis were done using SPSS 20.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations and medians for quantitative variables. Cronbach alpha coefficient was calculated to assess the reliability of the developed tools through their internal consistency. Qualitative categorical variables were compared using chi-square test. Whenever the expected values in one or more of the cells in a 2x2 tables was less than 5, Fisher exact test was used instead. In larger than 2x2 cross-tables, no test could be applied whenever the expected value in 10% or more of the cells was less than 5. Spearman rank correlation was used for assessment of the inter-relationships among quantitative variables and ranked ones. In order to identify the independent predictors of workers' scores of exposure and awareness, multiple linear regression analysis was used and analysis of variance for the full regression models was done. To identify the independent predictors of the risk of exposure and the use of PPE, multiple logistic regression analysis was used. Statistical significance was considered at p-value <0.05.

Results

Table 1 clarifies that 50% of the study sample was at age group < 40, with mean± SD equal 40.3±9.3, and 51% of them had secondary education. Regarding workers' demographic characteristic, 91% of them were married and 68% of them had insufficient income. Concerning residence, 63% of them belonged to rural areas and their homes were mainly not crowded (<2/ room) as reported by 72% of workers.

Table 2 reveals that 95% of the study sample consisted of welders, and among them, 63% initiated their jobs at the age of 18 years or older, with a mean± SD of 19.0±5.8. Concerning years of experience in welding, 40% of the workers had 10 years of experience, with a mean± SD of 13.3±7.3. In terms of daily work hours, 78% of workers worked for less than 9 hours per day, and 73% worked 5 days per week. Additionally, all workers had breaks, and 82% of them worked overtime.

Table 3 reveals that 36% of workers in the study sample had training in welding, 52.8% had formal training. As duration of training, 66.7% of them trained <1 year. Concerning welding type, 85% of worker used gas welding, as for gas type, 97.6% of them used carbon dioxide. Regarding body position at work 49% of worker was standing position at work and 74% of worker had license, while reasons for not having license 61.5% of worker said that it is not requested by company.

Table 4 describes overall exposures to occupational hazards and related problems as reported by workers in the study sample. As the table indicates that 100% of workers in the study sample exposed to physical hazardous exposures and physical problems, followed by 99% of workers mechanical hazardous exposures and 98% of workers had mechanical problems. Moreover 92% of workers exposed to chemical hazardous exposures and chemical problems. Also 81% of workers exposed to psychological hazards and psychological problems.

Figure 1: As illustrated in Figure 1, overall exposures to hazards were high 74% and 26% were low.

Figure 2: indicates that overall problems due to exposure were high 76% and 24% were low.

Table 5 shows that workers were aware to physical hazards, chemical hazard, accident hazard, mechanical hazard and psychological hazard (63%, 49%, 72%, 17%, 1%) respectively. In addition workers were aware to physical, chemical and mechanical problems (23%, 42%, 25%) respectively. On other hand, worker in the study sample were not aware of psychological problems.

As **figure 3** displays, total awareness of various occupational hazards and related problems were low (53%) and high (47%).

Table 6 illustrates the relations between workers' demographic characteristics and their reported exposure to occupational hazards. From this table it is evident that there was a statistically significant relation

between occupational exposure and marriage (P= 0.049).

As to the relation between workers' job characteristics and their reported exposure to occupational hazards. **Table 7** points to a statistically significant relation between occupational exposure and work shifts (P=0.04).

Table 8 displays relations between workers' welding job characteristics and their reported exposure to occupational hazards. This table indicates statistically significant relation between occupational exposure and type of training (P=0.02) and also having license (P=0.03).

In multivariate analysis, **Table 9** shows that the statistically significant independent positive predictor of the workers' to occupational accidents score were their educational level, age at start, total experience years, smoking, and knowledge score. The model explains 40% of the variation in this score. While none of the other characteristics had a significant influence on this score.

Discussion

Welders constitute a workforce whose well-being and operational capacity are influenced by specific job-related activities, exposing them to various hazards such as fumes and gases, excessive noise, vibrations, electricity, intense heat, unsuitable work postures, and stress. Furthermore, the act of welding itself may lead to a spectrum of health issues, encompassing physical, chemical, mechanical, and psychological problems. Recognizing and understanding these hazards and associated problems are crucial for enhancing the overall health and effectiveness of welders **(Tadesse et al., [18])**. Therefore, the primary objective of the present study is to evaluate the awareness of occupational health hazards and related problems among welders in Sharkia Governorate.

One of the main research questions of this study was about determining occupational health hazards and problems among welders in Sharkia Governorate. The results of current study revealed that all studied welders exposed to occupational health hazards over the past one year. All of studied welders exposed to physical hazards, almost all of them exposed to mechanical and chemical hazards and more than three quarters of welders exposed to psychological hazard. Furthermore, the overall exposure to hazards was high less than three quarters. From researchers point view, possible explanations might be related to results of current study are that more than four fifths of studied welders had work overtime, more than half of studied welders did not use personal protective equipment's.

Additionally, level of awareness to occupational hazards was low in more than half of studied welders. Moreover, the nature of welding job has numerous risk factors, including physical, chemical, mechanical and psychological. Exposure to these conditions may contribute to these occupational hazards. These findings was supported by study conducted by **Abd Alaleem, et al. [(9)]**, in Egypt and mentioned that the vast majority of welders were exposed to all types of occupational hazards, 100% of studied welders exposed to physical hazards as noise (85.2%), heat (84.8%), reich (91.1%) and vibrations (2.7%). In addition, 100% of studied welders exposed to mechanical hazards as 99.2% of them were standing for a long time. As well, 98.4% of them exposed to chemical hazards as 81.7% of welders exposed to gas & vapours. Lastly, 96.1% exposed to psychological hazards as wok overload (81.3%) and lack of cooperation (19.5%).

Moreover, these previous findings matched with those of **Onguto et al. [(13)]**, who carried out study in Embakasi, Nairobi City, Kenya and found that welders exposed to physical hazards as noise (89.7%) and sharps edges metals (78%). As well, this finding are consistent with study by **Chukwu et al. [(19)]**, **in** Nigeria and mentioned that 100% of welders were exposed to physical hazards as extreme heat, noise and 16.5% of them exposed to vibration. Additionally, 100% of welders were exposed to chemical hazards as fumes and gases.

As regards to occupational health problems, the results of present study displayed that all studied welders have experienced different types of occupational

health problems on the past one year, All of studied welders had physical problems, almost all of them had mechanical and chemical problems. Additionally, more than three quarters of them had psychological problems. Furthermore, overall problems due to exposures were high more than three quarters. From researchers point of view, this results might be due to overall exposure of studied welders to hazardous was high.

Surprisingly, the welding profession is considered to be one of the high-risk professions because it involves working with a range hazardous materials, tools, and equipment, which can lead to various types of injuries and illnesses. Moreover, level of awareness to occupational health problems was low and more than half of studied welders did not used personal protective equipment. Therefore, it is important for welders to take appropriate safety precautions, such as wearing PPE, using proper ventilation and lighting, and the appropriate welding techniques and equipment.

This outcome matched with study conducted by **Joshi et al. [16]**, in Banepa Municipality, Nepal and found that overall welders had familiarity various types of occupational health problems. As well, 99% of studied welders had physical problems as work-related accidents and injuries. Moreover, 70%, 37.69% and 45.5% had experienced musculoskeletal problems, respiratory problems and itching respectively. These results were supported by a study carried by **Abd Alaleem et al. [9]**, in Egypt, mentioned that all welders had physical problems as hearing problem (28.4%) and headache (82.5%).As well, 38.1% of them were complaining from respiratory problems. In the same study, 97.7% of welders had mechanical problems as neck pain (45.5%), tearing ligaments (4.7%) and backache (97.7%).

Moreover, this result matched with study conducted by **Onguto et al [13]** in Kenya and found that 19% of studied welders complaining shortness of breath and metal fume fever (60%). On the same context, These findings were in agreement with those of **Joseph et al. [20]**, in India and mentioned that 98.7% of welders suffered from one or other morbidities over the past one year, burns (38.7%), redness of eyes (65.8%), burning sensation in eye (53.5%), backache (63.9%) and cough (15.5%).

In addition, this results consistent with study by **Hassan et al. [21]**, in Pakistan and showed that the most frequent complaint was burn (48.6%), foreign body in the eye (47.1%), breathlessness (15.7%). These findings in the same line with study by **Tadesse et al. [18]**, in Addis Ababa, Ethiopia and found that breathlessness (29.9%) and hearing impairment (12.4%).

Regarding second research question of this study was about identifying welders' level of awareness towards occupational health hazards and problems, the results of present study indicated that the studied welders were aware of occupational hazards in their occupation but the level of their awareness deferred in the different occupational hazards, the highest level of awareness of hazards among studied welders was physical hazards, occupational accidents and followed by chemical hazards, while the lowest level of awareness was psychological and mechanical hazards.

Concerning awareness of occupational problems, the highest was chemical problems and on one of welder was aware to psychological problems. Additionally, the overall level of awareness of various occupational hazards and related problems of the current study was less than half of them had high awareness. From researchers point view, this result might be due to minority of studied welders had university education and nearly two thirds of them did not had training in the welding profession. Urgent nursing interventions can be formulated to improve awareness. So, the overall exposure to occupational hazards and related problems can be insured to reduce. As well, the safety and occupational health team in steel industries should implemented education & training programs session regularly.

This finding matched with study by **Chukwu et al. [19]**, in Nigeria and reported that 41.1% of welders had awareness regarding welding occupational hazards. This results agreement with **Gebrezgiabher et al. [17]**, in Ethiopia and revealed that 58.8% of

welders had awareness regarding chemical hazards and overall awareness of welders to occupational hazards was 44.2%

On other hand, the findings disagreement with study by **Joseph et al.** [20], in India" and indicated that 62.6% of welders were aware of occupational health hazards and 68% of welders had awareness of eye problems. Moreover, this results consistent with study by **Hassan et al.** [21], in Pakistan and showed that 54.3% of the studied welders were aware of welding hazards. In the same line, study done by **Nwafor et al.** [22], in Nigeria and mentioned that the awareness of welders on chemical hazards was 74.2%, followed by physical hazards 66.0%, mechanical hazard 62.7%, and lastly psychological hazard. Similarly, a study done in Kenya, by **Onguto et al.** [13] and mentioned that 90.2% of welders were aware of physical hazard.

The findings of this present study were lower as compared with several studied conducted for 90.7% in Nepal by **Budhathoki et al.** [23]; 98% in **Lusaka, Zambia** by **Z'gambo** [24]; 86.5% in **Ethiopia** by **Tadesse et al.** [18]; 99.3%, in **Nigeria** by **Tagurum et al.** [12]; 100% in **South Nigeria** by **Osagiede et al.** [6] in which welders were aware of at least one occupational health hazard associated with welding. This contradiction could be attributed to differences in geographical location and socio-demographic factors considered in the previous study. Finally the two research question of this study had achieved.

As regards the demographic characteristics of welders; concerning on education, the results of current study illustrated that more than half of studied welders had secondary education and minority of them had university education. From the point of view of the researchers, this result might be due to welding not require a certificate because it is profession not job. This results consistent with study conducted by **Nwafor et al.** [22] in Nigeria and revealed that 53% of welders had secondary educational level. Similarly, these findings matched with study conducted by **Tagurum et al.** [12], in South Nigeria mentioned that 44.1% of welders had secondary educational level. This results in same line with study carried out by **Z'gambo** [24] in Lusaka, Zambia and mentioned that 43% of welders had secondary educational level. Moreover, this finding matched with study by **Amabye** [25] in Ethiopia and found that 43.3% of studied welders had a secondary level.

According to job characteristics of welders. As, daily work hours, the current study findings illustrated that more than three quarters of welders worked less than 9 hours, while minority of them worked more than 9 hours per day. From the researcher's point of view, this may be due to application of labor law recommendations regarding worker daily work hours in most industries. The result disagreement by **Abd Alaleem et al.** [9] in Egypt who mentioned that more than two thirds of welders worked 12 hours per day, while less than one quarter of them worked > 10 hours per day. Similarly the previous study was matched with study conducted by **Z'gambo** [24] in Lusaka, Zambia who reported that 50% of welders worked for ≤ 7 hours per day.

According the relation between workers demographic characteristics and their reported exposure occupational hazards. The present study revealed that. There is statistically significant association between married and occupational exposure and there is no statistically significant association between age and occupational exposure. From the researcher's point of view, this might be due to the nature of welding profession lead to exposure to hazards and related health problems. So the welders were complained from more than one type of occupational health hazards. This results supported by study conducted **Abd Alaleem et al.** [9] in Egypt and indicated that no statistical significance difference between age of workers and physical, chemical & mechanical hazards.

Concerning the relation between workers job characteristics and their reported exposure to occupational hazards. The present study revealed that, there is statistically significant association between occupational exposure and work shifts, occupational exposure and type of training, occupational exposure and have license.

Conclusion:

The current study results bring about the conclusion that all studied welders exposed to occupational health hazards and related problems. The highest of occupational hazards were physical hazards followed by mechanical, chemical hazards and psychological hazard. Overall exposure to hazards was high less than three quarters. While, the total problems due to exposures was high more than three quarters. Regarding awareness of occupational hazards and related problems less than half of welders had high awareness.

Recommendations:

1. Implement a health education program aimed at enhancing welders' awareness of occupational health hazards and related problems.
2. Conduct regular education and training programs to consistently educate welders on occupational health hazards and associated problems.
3. Establish periodic medical examinations and follow-up procedures for all welders within their workplaces to identify and address potential health issues at an early stage.
4. Ensure the availability of a comprehensive handbook in all industries containing information about welding occupational hazards and their related problems.
5. Conduct additional studies in diverse industries to ascertain the extent of occupational health hazards and their associated problems, expanding the scope of understanding beyond the current focus.

Table 1: Demographic characteristics of workers in the study sample (n=100)

Demographic characteristics	Frequency	Percent
Age:		
<40	50	50.0
40-	29	29.0
50+	21	21.0
Range	**20-59**	
Mean±SD	**40.3±9.3**	
Median	**39.5**	
Education:		
Illiterate	16	16.0
Read/write	14	14.0
Basic	10	10.0
Secondary	51	51.0
University	9	9.0
Married:		
No	9	9.0
Yes	91	91.0
Income:		
Insufficient	68	68.0
Sufficient	32	32.0
Residence:		
Rural	63	63.0
Urban	37	37.0
Crowding index:		
<2	72	72.0
2+	28	28.0

Table 2: Job characteristics of workers in the study sample (n=100)

Job characteristics	Frequency	Percent
Job:		
Welder	95	95.0
Assistant	5	5.0
Age at start:		
<18	37	37.0
18+	63	63.0
Range	**7-49**	
Mean±SD	**19.0±5.8**	
Median	**18.0**	
Experience years in welding:		
<10	29	29.0
10-	40	40.0
20+	31	31.0
Range	**1-30**	
Mean±SD	**13.3±7.3**	
Median	**13.5**	
Daily work hours:		
<9	78	78.0
9+	22	22.0
Weekly working days:		
5	73	73.0
6	27	27.0
Have breaks	100	100.0
Work shifts	44	44.0
Work night shifts	34	34.0
Work double shifts	35	35.0
Work overtime	82	82.0
Overtime hours/month (n=82):		
<80	66	80.5
80+	16	19.5

Table 3: Welding job characteristics of workers in the study sample (n=100)

Welding job characteristics	Frequency	Percent
Trained in welding:		
No	64	64.0
Yes	36	36.0
Type of training (n=35):		
Informal	17	47.2
Formal	19	52.8
Duration of training (n=35):		
<1 year	24	66.7
1-2 years	5	13.9
3 years	7	19.4
Welding type:[@]		
Gas	85	85.0
Electric	59	59.0
Gas type (n=85):		
Carbon dioxide	83	97.6
Natural gas	2	2.4
Weld tanks	32	32.0
Weld painted surfaces	1	1.0
Body position at work:		
Standing	49	49.0
Sitting	10	10.0
Variable	41	41.0
Have license	74	74.0
Reasons for not having (n=26)		
No reason	5	19.2
Assistant	2	7.7
Not requested by company	16	61.5
Expired	3	11.5

(@) Not mutually exclusive

Table 4: Overall exposure to occupational hazards and related problems as reported by workers in the study sample (n=100)

Variables	Frequency	Percent
Exposed to:		
Physical hazardous exposures	100	100.0
Physical hazards (problems)	100	100.0
Chemical hazardous exposures	92	92.0
Chemical hazards (problems)	92	92.0
Mechanical hazardous exposures	99	99.0
Mechanical hazards (problems)	98	98.0
Psychological hazardous exposures	81	81.0
Psychological hazards (problems)	81	81.0

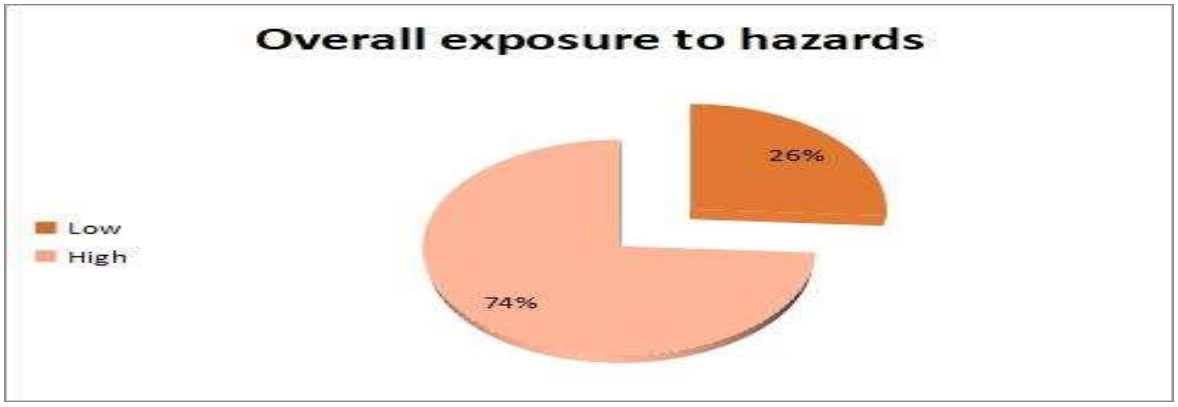

Figure 1: Overall exposures to occupational hazards as reported by workers in the study sample (n-100).

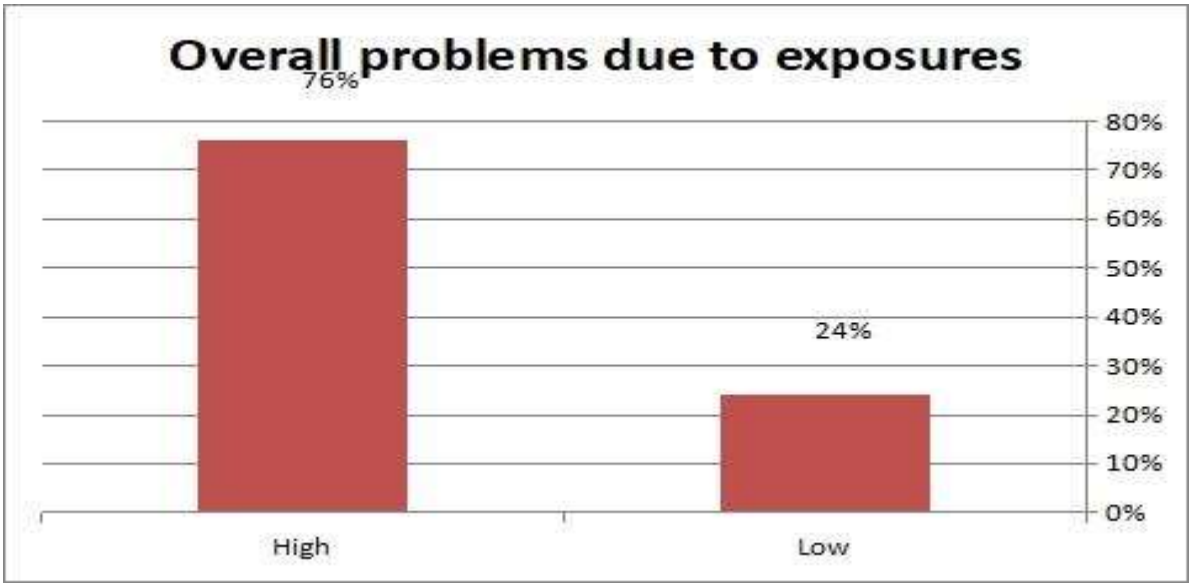

Figure 2: Overall problems due to exposure as reported by workers in the study sample (n-100).

Table 5: Overall awareness of various occupational hazards and related problems as reported by workers in the study sample (n=100)

Variables	Frequency	Percent
High awareness (60%+) of:		
Physical hazards	63	63.0
Chemical hazards	49	49.0
Accident hazards	72	72.0
Mechanical hazards	17	17.0
Psychological hazards	1	1.0
High awareness (60%+) of:		
Physical hazards problems	23	23.0
Psychological hazards problems	0	0.0
Chemical hazards problems	42	42.0
Mechanical hazards problems	25	25.0

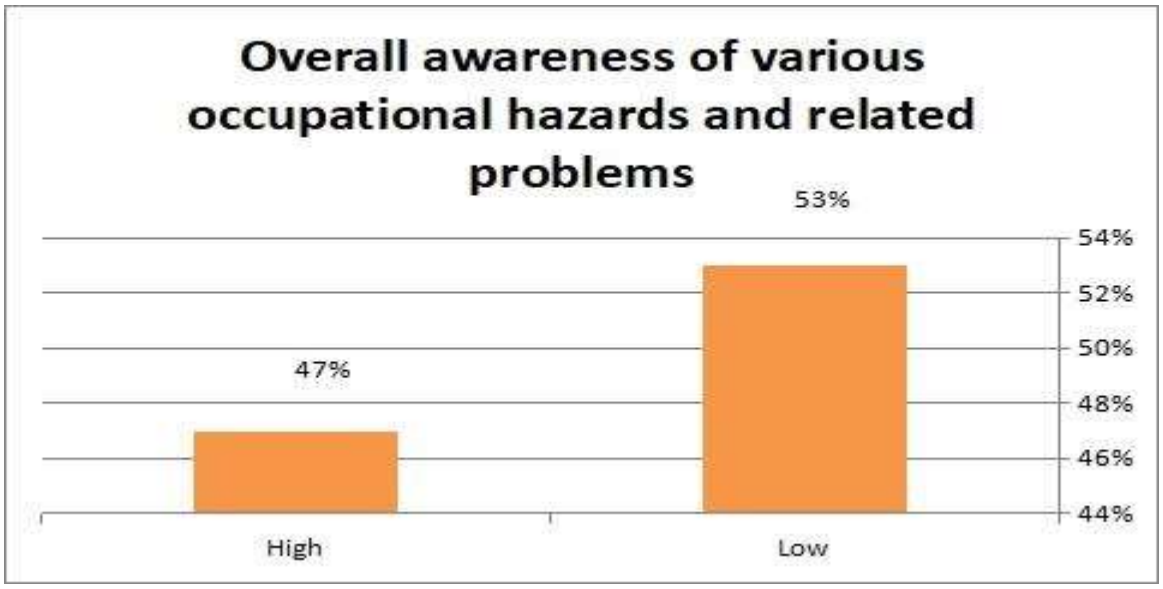

Figure 3: Overall awareness of various occupational hazards and related problems as reported by workers in the study sample (n-100).

Table 6: Relations between workers' demographic characteristics and their reported exposure to occupational hazards

Demographic characteristics	Occupational exposure				X^2 test	p-value
	Low		High			
	No.	%	No.	%		
Age:						
<40	14	28.0	36	72.0		
40-	7	24.1	22	75.9	0.21	0.91
50+	5	23.8	16	76.2		
Education:						
Below secondary	9	22.5	31	77.5		
Secondary	13	25.5	38	74.5	1.85	0.40
University	4	44.4	5	55.6		
Married:						
No	5	55.6	4	44.4		
Yes	21	23.1	70	76.9	Fisher	0.049*
Income:						
Insufficient	16	23.5	52	76.5		
Sufficient	10	31.3	22	68.8	0.67	0.41
Residence:						
Rural	19	30.2	44	69.8		
Urban	7	18.9	30	81.1	1.53	0.22
Crowding index:						
<2	18	25.0	54	75.0		
2+	8	28.6	20	71.4	0.13	0.71

(*) Statistically significant at p<0.05

Table 7: Relations between workers' job characteristics and their reported exposure to occupational hazards

job characteristics	Occupational exposure				X^2 test	p-value
	Low		High			
	No.	%	No.	%		
Job:						
Welder	24	25.3	71	74.7		
Assistant	2	40.0	3	60.0	Fisher	0.60
Age at start:						
<18	7	18.9	30	81.1		
18+	19	30.2	44	69.8	1.53	0.22
Experience years in welding:						
<10	8	27.6	21	72.4		
10-	13	32.5	27	67.5	2.49	0.29
20+	5	16.1	26	83.9		
Experience years (total):						
<10	5	33.3	10	66.7		
10-	8	29.6	19	70.4	0.99	0.61
20+	13	22.4	45	77.6		
Daily work hours:						
<9	23	29.5	55	70.5		
9+	3	13.6	19	86.4	2.24	0.13
Weekly working days:						
5	17	23.3	56	76.7		
6	9	33.3	18	66.7	1.03	0.31
Work shifts:						
No	19	33.9	37	66.1		
Yes	7	15.9	37	84.1	4.16	0.04*
Work night shifts:						
No	19	28.8	47	71.2		
Yes	7	20.6	27	79.4	0.78	0.38
Work double shifts:						
No	19	29.2	46	70.8		
Yes	7	20.0	28	80.0	1.01	0.32
Work overtime:						
No	4	22.2	14	77.8		
Yes	22	26.8	60	73.2	Fisher	0.78
Overtime hours/month (n=82):						
<80	20	30.3	46	69.7		
80+	2	12.5	14	87.5	Fisher	0.21

(*) Statistically significant at p<0.05

Table 8: Relations between workers' welding job characteristics and their reported exposure to occupational hazards

Welding job characteristics	Occupational exposure				X^2 test	p-value
	Low		High			
	No.	%	No.	%		
Trained in welding:						
No	19	29.2	46	70.8		
Yes	7	20.0	28	80.0	1.01	0.32
Type of training (n=35):						
Informal	7	41.2	10	58.5		
Formal	1	5.3	18	94.7	Fisher	0.02*
Welding gas:						
No	7	46.7	8	53.3		
Yes	19	22.4	66	77.6	Fisher	0.06
Welding electric:						
No	13	31.7	28	68.3		
Yes	13	22.0	46	78.0	1.18	0.28
Gas type (n=85):						
Carbon dioxide	19	22.9	64	77.1		
Natural gas	0	0.0	2	100.0	Fisher	1.00
Weld tanks:						
No	20	29.4	48	70.6		
Yes	6	18.8	26	81.3	1.29	0.26
Weld painted surfaces:						
No	26	26.3	73	73.7		
Yes	0	0.0	1	100.0	Fisher	1.00
Body position at work:						
Standing	13	26.5	36	73.5		
Sitting	4	40.0	6	60.0	1.38	0.50
Variable	9	22.0	32	78.0		
Have license:						
No	11	42.3	15	57.7		
Yes	15	20.3	59	79.7	4.86	0.03*

(*) Statistically significant at p<0.05

Table 9: Best fitting multiple logistic regression model for the reported occupational accidents

Variables	Wald	Df	P	OR	95.0% CI for OR	
					Upper	Lower
Constant	6.04	1.00	0.01	0.00		
Education level	2.89	1.00	0.09	0.61	0.34	1.08
Age at start	6.09	1.00	0.01	1.24	1.04	1.47
Total experience years	11.32	1.00	<0.001	1.16	1.06	1.27
Smoking	5.03	1.00	0.02	2.30	1.11	4.75
Knowledge score	3.40	1.00	0.07	2.83	0.94	8.57
Nagelkerke R Square: 0.40						
Hosmer and Lemeshow Test: p=0.934						
Omnibus Tests of Model Coefficients: p<0.001						
Variables entered at start: age, , income, residence, marital status, smoking, , job, experience, welding type, work hours and overtime, use of PPE, health care availability, company						

References:

1. Sah, R.C., & Sah, D.P. Study, Awareness, and Policy Advocacy for the Prevention of Occupational Exposure to Welding Fumes among Metal Fabricators in Nepal. Center for Public Health and Environmental Development. Kathmandu; Nepal. 2022. P.p.3.

2. Ramachander, J. Welding Materials Developmental Direction and Effectiveness Improving Processes. *International Journal of Innovative Research In Science and Engineering*. 2016**,** 2(10), 121-133.

3. Hughes, P., & Ferrett, E. International Health and Safety at Work: for the Nebosh. International General Certificate in Occupational Health and Safety. (3rd Edition), New York: Routledge. 2021. P. 3.

4. Lebni, J.Y., Azar, F.E., Sharma, M., Zangeneh, A., Kianipour, N., Azizi, S. A., Jalali, A., & Ziapour, A. Factors Affecting Occupational Hazards Among Operating Room Personnel at Hospitals Affiliated in Western Iran: a Cross-Sectional Study. *Journal of Public Health*. 2021, 29(5), 1225-1232.

5. Abd El Hamid, M.A.E.F., Ali, S.A., & Kamel, W.W. Occupational Health Hazards among Sewage Workers at Al-Qalyobia Governorate*. Zagazig Nursing Journal*. 2016, 12(2), 204-220.

6. Osagiede E.F. , Ilokhor O.k ., Ehimen F.A., Airefetalor I.A., Otaigbe O.I., & Abah S.O. Assessment of Awareness of Occupational Health Problems, and the Practices of Safety Measures among Welders in a Semi-Urban Town in South-South Nigeria. *Western Journal of Medical and Biomedical Sciences*. 2020, 1(2), 139-149.

7. Mgonja C.T. The Effects of Arc Welding Hazards to Welders and People Surrounding the Welding Area. *International Journal Of Mechanical Engineering And Technology*. 2017, 8(3), 433-441.

8. Abu-Elmatty, G.M., Gida, N.I.M., Hafez, F.E. & Mahmoud, H.M.A. Occupational Health Hazards and Safety Measures among bakery Workers at Port Said city. *Port Said Scientific Journal of Nursing*. 2022, 9(1), 330-352.

9. Abd Alaleem, A.M., Ibrahim, H.D.F., Magrabi, E., & Mohamed, N. Identification of Occupational Health Hazards and Protective Measures among Workers in Welding Workshops at Beni Suef City. *Assiut Scientific Nursing Journal*. 2018, 6(14), 49-59.

10. Attia, N.M.N., Ali, S.A., & Ahmed, F. M. Effect of Health Education Intervention on Controlling Occupational Health Hazards among Housekeeping Workers at Zagazig University Hospitals. Doctora thesis Faculty Of Nursing Zagazig University. 2022. P.p. 7-32.

11. Wanjari, M.B., & Wankhede, P. Occupational Hazards Associated with Welding Work that Influence Health Status of Welders. *International Journal of Current Research and Review*. 2020, 12(23), 51-55.

12. Tagurum, Y.O., Gwomson, M.D., Yakubu, P.M., Igbita, J.A., Chingle, M. P., & Chirdan, O.O. Awareness of Occupational Hazards and Utilization of Ppe amongst Welders In Jos Metropolis, Nigeria. *Int J Res Med Sci*. 2018, 6(7), 2227-2233.

13. Onguto ,N.O., Mwanzo, I., & Warutere, **P.** Physical Hazards and Reported Health Effects among Welders in the Small and Medium Enterprise berSector in Embakasi, Nairobi City County, Kenya. Master Thesis Of Public Health (Epidemiology and Disease Control) in The School of Public Health and Applied Human Sciences of Kenyatta University. 2020. P.p.1-95.

14. Baye, B.B., Baye, M.B., Teym, A., & Derseh, B.T. Utilization of Personal Protective Equipment and Its Associated Factors Among Large Scale Factory Workers in Debre Berhan Town, Ethiopia. *Journal of Environmental Health Insights*. 2022, 1-9.

15. Saqlain, M., Munir, M.M., Rehman, S.U., Gulzar, A., Naz S., Ahmed, Z., Tahir, A.H., & Mashhood, M. Knowledge,

Attitude, Practice and Perceived Barriers among Healthcare Workers Regarding COVID19: A Cross- Sectional Survey From Pakistan. *Journal Of Hospital Infection*. 2020,105 (3), 419-423.

16. Joshi, M., Dhakal, G., & Shrestha, S. Occupational Health Problems, Workplace Environment and Utilization of Personal Protective Equipment among Welders of Banepa Municipality. *International Journal of Occupational Safety and Health*. 2020, 10(2), 100-107.

17. Gebrezgiabher, B., Tetemke, D., & Yetum,T. Awareness of Occupational Hazards and Utilization of Safety Measures among Welders in Aksum and Adwa Towns, Tigray Region, Ethiopia, 2013. *Journal of Environmental and Public Health*. 2019, 1-7. Retrieved from Https://Doi.Org/10.1155/2019/4174085

18. Tadesse, S., Kelaye, T., & Assefa, Y. Utilization of Personal Protective Equipment and Associated Factors among Textile Factory Workers at Hawassa Town, Southern Ethiopia. *Journal of Occupational Medicine and Toxicology*. 2016, 11(1), 1-6.

19. Chukwu, R.O., Okereke, Chike C.A, Iwuoha, Gregory, Anochie, Christopher C. , Chikwe, Chidinma, M. , Nwoke Eunice. A. Occupational Hazards and use of Personal Protective Equipment among Small Scale welders in Owerri North LGA, Imo State, Nigeria. *IOSR Journal of Nursing and Health Science*. 2019, 8(6), 22-30.

20. Joseph, N., Venkatesh, V., Akash, S. K., Hegde, S., Moras, E., & Shenoy, N. P. Occupation hazards–pattern, awareness and preventive measures among welders from an unorganized sector in India. *Journal of clinical and diagnostic research: JCDR*. 2017, 11(5), 23-28.

21. Hassan, S. M., Nasir, U., Anwar, K., & Talib, U. An assessment of the level of awareness and reported complaints regarding occupational health hazards and the utilization of personal protective equipments among the welders of Lahore, Pakistan. *International journal of occupational and environmental health*. 2017, 23(2), 98-109.

22. Nwafor, A.U., Irondi, C.O., & Okenna, A.O. Occupational hazards and safety practices among welders in Port Harcourt metropolis, Nigeria. *Intentional Journal of Innovative Research and Development (IJIR&D)*. 2019, 8(10), 119-124.

23. Budhathoki, S.S., Singh, S.B., Sagtani, R.A., Niraula, S.R., & Pokharel, P.K. Awareness of occupational hazards and use of safety measures among welders: a cross-sectional study from eastern Nepal. *BMJ open*. 2014, 4(6), 1-6.

24. Z'gambo, J. Occupational Hazards and Use of Personal Protective Equipment among Small Scale Welders in Lusaka, Zambia. (Master's Thesis, Faculty of Medicine and Dentistry the University of Bergen,Norway). 2015. P. 7.

25. Amabye, T.G. Occupation risks and hazards exposure, knowledge of occupational health and safety practice and safety measures among workers of sheba leather plc, wukro, tigray Ethiopia. *MOJ Public Health*.2016, 4(2), 39-45.