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Research Article

Prevalence of Visual Impairment and Associated Factors Among Welders in West Shewa Zone Oromia Region, Ethiopia

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Background: Visual impairment is one of the major causes of public health problems and is highly devastating in developing countries, including Ethiopia. Visual impairment is associated with a limitation of eye function and the visual system due to various factors that cause poor vision in either one or both eyes. This problem compromises life and, particularly, vision-related quality of life. The prevalence and contributing factors of visual impairment among welders have not been well studied in Ethiopia. Therefore, this study aimed to assess the prevalence of visual impairment and associated factors among welders in the West Shewa Zone, Oromia Region, Ethiopia.
Methods: A community-based cross-sectional study design was employed among 634 welders at five woredas towns in the West Shewa zone, Oromia, Ethiopia, from September 20 to November 20, 2022. A cluster sampling method was used to involve study participants. Interviewer-based structured questionnaires and a Snellen chart were used to collect data from eligible subjects. EPI DATA version 3.1 was used to enter the data, which was then exported to SPSS version 25 for analysis. Bi-variable and multi-variable logistic regression were performed to identify factors associated with visual impairment. The data were presented as an odds ratio (OR) with a 95% CI, and variables associated at P-value<=0.05 were considered statistically significant.
Results: In this study, 634 welders participated. The mean age of study participants was 29.13+8.06 SD. Among the study subjects, 29.34% (95% CI: 26.6-32.3%) of respondents had visual impairment. Factors including training on eye personal protective equipment use (AOR=1.77; 95% CI: 1.21-2.60), working hours per day (2.78, 95% CI: 1.91-4.06), and not using eye personal protective equipment (AOR=1.83, 95% CI: 1.12-2.99) were significantly associated with visual impairment.
Conclusion: Based on this study, the prevalence of visual impairment among welders was 29.34%. Factors including the absence of training on eye personal protective equipment use, prolonged working hours per day, and not using eye

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personal protective equipment were identified as risk factors for visual impairment.

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Introduction

Our eye is the organ of sight that collects information about our surroundings, and the brain interprets a mental picture of what we see [1]. Therefore, most of our impressions of the world and our memories of it are primarily based on sight [2]. The strength of the hyperpolarizing output signal for rods and cones is proportional to the intensity of light [3]. Chemical reactions that occur in the photosensitive pigments present in rods and cones lead to the formation of electrical activity in the retina and the generation of impulses (AP), which are transmitted via the optic nerve [4]. If there is any defect in the structure and physiology of the visual system, it will lead to visual impairment [3].

Depending on the World Health Organization (WHO) classification, visual impairment (VI) is determined as presenting visual acuity (PVA)<6/12 in the better eye, and PVA in the better eye of<3/60 is classified as blindness [5]. This is achieved by measuring visual acuity (VA) via the Snellen chart at a distance of 6 meters (m), and visual acuity would be recorded as the smallest line in which the individual being tested can identify the letters correctly [6].

Visual impairment is a major public health concern that can negatively affect the quality of life (QOL) and compromise the socioeconomic status of an individual, the society, and the country at large [7]. Approximately 89% of visually impaired people live in developing nations, with 37.58% in Ethiopia [8]. Since welding is a widely used practice in developing countries, including Ethiopia, it is the most intense artificial source of invisible and visible optical radiation that can impair human vision [9]. Long-term exposure to ultraviolet radiation is associated with conditions like pterygia, pinguecula, band-shaped keratopathy, and climatic droplet keratopathy [10].

Visual impairment profoundly influences the quality of life, financial strain, declines in social integration, productivity, and increased dependence [11]. This leads to limitations in all areas of life, and particularly, vision-related quality of life will be compromised [12]. Previous studies have revealed that welders' age, sex, income, educational status [6][9][13][14], alcohol consumption, cigarette smoking [15], work experience, use of eye PPE, workplace policy concerning the use of eye PPE, type of welding, duration of work, training [16][17][18] were affecting visual impairment[19][20][21].

Even if a visual impairment is caused by different factors, the traumatic condition is listed as a major cause of VI among welders due to the possibility of flying metal and the emission of ultraviolet rays (UVR). UV rays cause corneal ulcers and other ocular abnormalities that lead welding workers to be visually impaired [12][9]. In different countries, research shows that they have laws

enforcing welders to use eye PPE and have awareness-creating training for welders [9][20][22].

However, in Ethiopia, there is a gap in awareness-creating training for welders on what and why they use PPE to prevent eye injury from welding activities. Even though there are visual impairment studies conducted in the country, VI among welders has been given little attention. Therefore, the current study aims to assess the prevalence of VI and associated factors among welders in the West Shewa zone, Oromia Region, Ethiopia, 2022.

Method and Materials

Study setting and Design

The community-based cross-sectional study was conducted from September 20 to November 20, 2022, in the Oromia Region West Shewa zone, Ambo city. Ambo is the capital town of the West Shewa Zone; located 114 kilometers west of the capital city of Ethiopia, called Addis Ababa. The West Shewa zone includes 22 districts. According to data from the zonal health office, the zone's overall population was estimated to be 2,381,079 people, with 1,166,729 males.

Study participants

The source population was all welding workers at woreda towns of the West Shewa zone, whereas the study population was all welders from five selected towns available during the study period.

Inclusion criteria

This study included welders of all types older than 18 years who can give consent to participate in the study.

Exclusion

Welders with known cognitive disabilities.

Sample size determination and sampling techniques

By using a simple random sampling method, five towns of the woreda were selected from the 22 listed below West Shewa zone woredas towns. Then, a cluster-sampling technique was employed to select welders from the selected five woreda towns used as study participants. The sample size (n) was determined by using the single population proportion formula. Since there was no evidence within a similar study to estimate the minimum sample size, the P-value was taken as P = 0.5, the proportion of the population with VI, 5% margin of error, 95% confidence level, and 10% non-response rate were considered to calculate the sample size.

$$\mathrm{n} = \mathrm{Z}^2\mathrm{p}(1-\mathrm{p})/\mathrm{d}^2 \rightarrow n = \frac{(1.96)^2 0.5 * 0.5}{(0.05)^2} = 385.$$

Where:

- **n**= sample size
- **d**= margin of error 5%,
- **P**= proportion 0.5 %,

- **Zα/2**= at 95% confidence interval

Which equals 1.96 (Z value at alpha=0.05).

Accordingly, the sample size was calculated to be 385, and considering a 10% non-response rate (385*10% = 39), the total sample size required would be 385+39= 424 for all respondents. Since the sampling procedure was cluster sampling, a design effect of 1.5 was taken, so the total sample was 424*1.5= 636.

Data collection procedures and tools

After receiving written informed consent from each study participant, socio-demographic, behavioral, environmental, clinical, and worksite-related data of the participants were collected using pre-tested structured questionnaires. The data collection tool was adopted from related different literature and the World Health Organization (WHO). Visual acuity was performed with the aid of the Snellen chart. The participant was positioned standing or seated based on their option at 6 meters away from the chart. Each eye was tested separately. The technique was carried out in a well-illuminated room or place that was convenient for the welders. Five ophthalmic nurses and one public health officer participated in data collection.

The ophthalmic nurses performed a VA test for each eye using the Snellen chart at a distance of 6 m, after filling out the structured face-to-face interviews and questionnaires. Furthermore, prevention approaches to COVID-19 transmission, such as physical distancing during an interview, face masks, and hand rubbing with sanitizer before and after, were strictly followed in every procedure of data collection.

Data processing and statistical analysis

Data from five woreda towns were checked for completeness, cleaned, and entered into Epi Data-version 3.1 before being exported to SPSS version 25 for analysis. The data were combined and analyzed using descriptive statistics and logistic regression. Descriptive statistics were used to summarize the data using frequencies and percentages. Both binary and multivariable logistic regression analyses were performed to identify factors associated with visual impairment.

The variables in bi-variable analysis with $p<0.2$ were entered into a multivariable logistic regression model. An adjusted odds ratio (AOR) with a 95% confidence interval (CI) was used to determine the association between dependent and independent variables. Multi-collinearity and fitness of the model were checked before the multivariable logistic regression analysis was performed. Model fitness was tested by the Hosmer-Lemeshow goodness of fit test, and the model was adequately fit with $p>0.05$. The statistical significance of the association between dependent and independent variables was declared at a p-value<0.05.

Results

Socio-demographic characteristics of study participants

634 welders were included in this study. Among the study participants, about 162 (24.8%) welders were from Guder, 97 (14.9%) welders were from Gedo, 103 (15.8%) welders were from Ginchi, 89 (13.6%) welders were from Ejere, and 183 (28%) welders were from Ambo, respectively. The detailed socio-demographic characteristics of study participants are depicted in (Table 1).

Variables	Category	Frequency (n=634)	(%)
Age(years)	18-44	592	93.4
	45-64	41	6.5
	>64	1	0.1
Sex	Male	633	99.8
	Female	1	0.2
Educational Levels	No formal education	159	25.1
	Primary education	155	24.4
	Secondary education	118	18.6
	College and above	202	31.9
Average monthly income	<=1999 ETB	169	26.7
	2000-6999 ETB	255	40.2
	>=7000 ETB	210	33.1

Table 1. Socio-demographic characteristics of welders at five woreda towns in West Shewa zone Oromia Region, Ethiopia, 2022(n=634)

**ETB=Ethiopian Birr*

Behavioral and environmental factors among welders

The behavioural and environmental characteristics of respondents at five selected woreda towns were assessed. Among the respondents, 164 (25.9%) were coffee drinkers. When the smoking status of welders was assessed, most of them, 562 (88.61%), were non-smokers. However, only 5.4 percent of welders were smokers and smoked more than 5 cigarettes per day. The detailed behavioral and environmental factors are depicted in Table 2 below.

Variable	Category	Frequency (n=634)	Percent
Smoking cigarette	Yes	72	11.4
	No	562	88.6
Which smoker type	Current smoker	38	5.99
	Ever smoker	34	5.4
Numbers of cigarettes	< 5 Pieces/day	38	5.99
	>=5 Pieces/day	34	5.4
Alcohol drinking	Yes	92	14.5
	No	542	85.5
Which drinker type	Current	40	6.3
	Ever	52	8.2
Chemical exposure	Yes	33	5.2
	No	601	94.8

Table 2. Behavioral and environmental characteristics of respondents at five selected woreda towns of West Shewa zone Oromia Region, Ethiopia, 2022

Clinical characteristics of the participants

In terms of previously known chronic diseases, 625 (98.6%) of the study participants responded that they had no known chronic disease. Only nine (1.4%) of the participants had a history of known chronic diseases. Among the chronic diseases, hypertension accounted for 5 (0.78%), diabetes mellitus was 2 (0.31%), and heart disease was 2 (0.31%), respectively. The detailed clinical characteristics of study participants are depicted in Table 3.

Variable	Category	Frequency	Percent
History of known chronic diseases	Yes	9	1.4
	No	625	98.6
Types of chronic diseases	DM	2	0.31
	HTN	5	0.78
	Heart disease	2	0.31
Do you have a previous ocular disease?	Yes	51	8.0
	No	583	92.0
Types of eye disease	Trachoma	6	.9
	Cataract Glaucoma	14 9	2.2 1.4
	Other	22	3.5
Have you experienced eye symptoms during welding	Yes	463	73
	No	171	27

Table 3. Clinical/illness characteristics of respondents at five selected woreda towns of West Shewa zone OromiaRegion, Ethiopia, 2022(n=634)

Note: HTN= Hypertension DM= Diabetes mellitus other= Trauma

Working place-related characteristics of the participant

The majority of study participants, 62.6%, have been working as welders for more than five years. However, only 15.1% of participants had welding experience<=2 years. Among the study participants, 195 (30.8%) respondents had been trained on how to use eye personal protective equipment (PPE). Based on the type of welding, the most common welding type used in this study was electric/arc welding (95.7%). More than half of the participants (66.6%) work less than 8 hours per day, while 33.4% of them work more than 8 hours per day. A detailed description of workplace characteristics is depicted in the below Table 4.

Variable	Category	Frequency	Percent
Trained on how to use eye PPE	Yes	195	30.8
	No	439	69.2
Work experience	<=2yrs	96	15.2
	3-4yrs	141	22.2
	>=5yrs	397	62.6
Time of working per a day	< 8hrs	422	66.6
	>= 8hrs	212	33.4
Eye injury at the time of welding	Yes	211	33.3
	No	423	66.7
Nature of injury	Trauma	99	15.6
	Entrance of metal Pieces	112	17.7
Do you use any eye PPE when welding?	Yes	543	85.6
	No	91	14.4
Types of PPE used during welding	Eyeglasses	377	59.5
	Goggles	121	18.1
	Eye shields	45	7.3
How often do you use PPE	Always	328	51.7
	Some times	215	33.8
The reason for using PPE sometimes	Feeling Un comfortable	62	9.8
	Feeling too much heat	81	12.8
	Short duration of work	72	11.4
Mainly working outdoor	Yes	189	29.8
	No	445	70.2

Table 4. Working place-related characteristics of respondents at five selected woreda towns of West Shewa zone Oromia Region, Ethiopia, 2022(n=634)

Prevalence of visual impairment

The visual impairment of welders was assessed, and out of 634 welders, 29.34% (95% CI: 26.6-32.3%) of them had visual impairment. Out of 186 visually impaired welders, 79 (42.47%) stated they had bilateral VI, and 107 (57.53%) had monocular VI, as shown below in Figure 1.

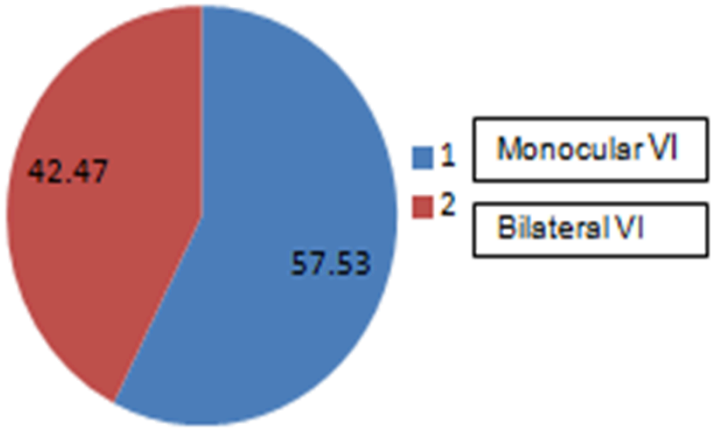

Figure 1. Prevalence of bilateral and monocular visual impairment of welders from five selected woreda towns of West Shewa zone, Oromia Region, Ethiopia, 2022

Severity of visual impairment among study participants

Among the total assessed welders, 12 (1.9%) had severe VI in the right eye, and 7 (1.1%) had severe VI in the left eye. Additionally, 47 of them had moderate VI in the right eye, and 5.7% of them had moderate VI in the left eye. The details of visual impairment severity are depicted below in Table 5.

VI of RT eye	Categories	Frequency(n=634)	Percent
6/60	Severe VI	12	1.9
6/36	Moderate VI	47	7.4
6/18	Mild VI	72	11.4
6/12 and 6/6	Normal	503	79.3
VI of Lt eye			
6/60	Severe VI	7	1.1
6/36	Moderate VI	36	5.7
6/18	Mild VI	91	14.3
6/12 & 6/6	Normal	500	78.9

Table 5. The severity of visual acuity at five selected woreda towns of West Shewa zone, Oromia Region, Ethiopia, 2022 (n=634)

VI=visual impairment, Lt=left; Rt=right

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Factors associated with visual impairment

To identify the association between visual impairment and explanatory variables, bi-variable logistic regression analysis was first done for all independent variables. A total of ten variables were found to be associated in the crude analysis and were candidates for multivariable analysis with a p-value<0.2.

These variables include income, drinking coffee, cigarette smoking, drinking alcohol, exposure to chemicals, training on eye PPE use, welding types, working experience, working hours per day, and eye PPE use, as indicated in Table 6.

Before running the multivariable logistic analysis, the Hosmer-Lemeshow goodness of fit (p = 0.449) and multicollinearity (VIF = 1.07) were tested, and the model was adequately fit with no multicollinearity among the variables. The candidate variables identified for multivariable logistic regression analysis were run by multiple logistic regressions.

Then, three variables, namely: training on eye PPE use, working hours per day, and eye PPE use, were significantly associated with visual impairment among welders at a p-value <= 0.05.

Accordingly, the multiple logistic regression model showed that welders who did not use eye PPE while working were 1.83 times more likely to have visual impairment than those who did use eye PPE (AOR = 1.83, 95% CI: 1.12-2.99).

Furthermore, welders who did not have any training on the use of eye PPE were also 1.77 times more likely to have visual impairment than those who had training on the use of eye PPE (AOR = 1.77; 95% CI: 1.21-2.60). The risk of developing visual impairment was 2.78 (95% CI: 1.91-4.06`) times higher for welders welding more than 8 hours per day as compared to welders welding less than 8 hours per day.

Variable	Category	Visual Impairment		Bivariable	Multivariable	
		YES (%)	NO (%)	COR (95% CI	AOR	P-value
Income	<=1999ETB	56(30.1)	113(69.9)	1		
	2000-6999ETB	84(32.9)	171(67.1)	.99(.60-1.46)	.94(.60-1.46)	.790
	>=7000ETB	46(21.9)	164(78.1)	1.75(.96-2.53)	1.56(.96-2.53)	.073
Drinking coffee	Yes	55(33.5)	109(66.5)	.76(.52-1.19)	.79(.52-1.19)	.264
	No	131(27.9)	339(72.1)	1		
Cigarette smoking	Yes	26(36.1)	46(63.9)	.70(.42-1.33)	.76(.43-1.32)	.326
	No	160(28.3)	402(71.7)	1		
Drink alcohol	Yes	31(33.7)	619(66.3)	.79(.60-1.72)	1.02(.64-1.72)	.945
	No	155(28.6)	387(71.4)	1		
Exposure to chemical	Yes	13(39.4)	20(61.6)	.62(.36-1.71)	.79(.37-1.71)	.554
	No	173(28.8)	428(71.2)	1		
Training on Eye PPE used	Yes	79(40.5)	116(59.5)	1		
	No	107(24.4)	332(75.6)	2.11(1.19-2.58)	1.77(1.21-2.60)	**.003***
Welding types	Electrical/arc	175(28.8)	432(71.2)	1.75(.76-4.26)	1.80(.76-4.26)	.183
	Gas	11(40.7)	16(59.3)	1		
Working experience	< =2yrs	21(21.8)	75(78.2)	1		
	3-4yes	31(21.9)	110(78.1)	1.04(.54-2.02)	1.05(.54-2.02)	.895
	>=5yrs	134(33.7)	263(66.3)	.76(.43-1.33)	.76(.43-1.33)	.338
Working hours per day	< 8hrs	89(21.1)	333(78.9)	1		
	>=8hrs	97(45.7)	115(54.3)	3.15(1.91-4.07)	2.78(1.91-4.06)	**000***
Eye PPE using	Yes	149(27.4)	394(72.6)	1		
	No	37(40.6)	54(59.4)	1.81(1.11-2.99)	1.83(1.12-2.9)	**.017***

Table 6. Bi-variable and multivariable analysis of different independent variables with dependent variables among selected woreda towns of West Shewa zone Oromia Region, Ethiopia, 2022(n=634). Below Table 6

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** values statistically significant (P-value< 0.05) COR- Crude odds ratio AOR- Adjusted Odds ratio CI-Confidence interval 1- reference*

Discussion

This study was conducted to determine the prevalence of visual impairment and associated factors among welders. The current study revealed that the prevalence of VI among welders was 29.34% (95% CI: 26.6-32.3%). This finding was consistent with previous studies conducted in Nigeria (27%) (31) and Northwest Ethiopia 31% [6]. However, the current finding was lower than studies done in Malaysia (55.4%)(44). The possible discrepancy might be due to the fact that the study in Malaysia included a larger sample size (n=1522).

The study in India, conducted among one hundred and eighty small-scale metal industry workers, revealed that 74% had visual impairment (45). The possible difference might be age variation. The mean age of Indian participants was older, with a mean age of 45.5 +11.31 years, which could be attributed to differences. The sampling technique used by the Indian study was also different from this study, which accounts for a possible variation in the result.

Nevertheless, the current study was higher than a study done in Pakistan, which stated that prevalence as (7.3%) (46), Chennai 12.7% (47), and India 23.4% (28). The possible reasons might be differences in geographical and environmental factors, and the availability of eye safety devices.

In my study, training on eye PPE use, working hours per day, and eye PPE use were significantly associated with visual impairment among welders. Accordingly, this study revealed that the odds of developing visual impairment among those who fail to use appropriate eye personal protective equipment during welding activities were 1.83 times higher than users. This finding was in line with previous studies conducted in Pakistan (46), Malaysia (44), Nigeria [12], Ghana [21], and Ethiopia (48). The possible mechanism might be that welders are a high-risk group for visual impairment as a result of exposure to metals and ultraviolet radiations.

The detrimental effects of welding stem from the extended exposure to mild rays, infrared, and ultraviolet (UV) radiation, all of which were emitted in a variety of degrees with the aid of several kinds of welding (38,39). UV radiation was absorbed by the cornea and lens, with the lens absorbing more of the radiation at wavelengths approaching 400 nm. This absorption creates chemical changes in the lens, which is prone to cataract formation that causes VI (25). Therefore, protection from UV radiation is normally afforded by the use of welding helmets (PPE). However, the chance of exposure might exist if such helmets are both not available or not used effectively[16].

A research from western Rajasthan of India revealed that the prevalence of maculopathy and other eye disorders was found to be lower among those strictly adherent to personal protective equipment than among occasional users (50). This could be explained as visible and IR spectrum rays penetrating the eye and reaching up to the retina and might cause thermal and photochemical changes. Acute and chronic injury from UV radiation also causes photokeratitis, known as welders' eye. In line with our findings, a study in South Africa revealed that insufficient personal protective equipment use causes welding flashes (51).

Regarding having been trained on eye PPE used, welders who did not have training on eye personal protective equipment used during the first time for

welding were more likely to have a visual impairment (AOR = 1.77; 95% CI: 1.21-2.60) than those who had training. This result was in agreement with studies done in Ghana [16].and Nigeria(53,54). The possible reason could be that those who have training on eye personal protective equipment might have information on how their working environment predisposes them to different ocular problems when not using protective devices and which specific type of eye PPE must be used to prevent the eye from exposure to UV radiation and ocular injuries, which is the main risk for VI [16].

The occurrence of visual impairment was significantly associated (AOR=2.78, 95% CI: 1.91- 4.06) with working more than eight hours per day among welders. This finding is supported by other findings done in Nepal[17], and Uganda [18]. Those welders working more than 8 hours per day had a higher risk of having visual impairment as compared to those who were working less than 8 hours per day. This might be because long-time exposure to UV radiation might cause the loss of endothelial cells, which might be followed by the development of macular drusen among welders.

The possible underlying mechanism of the retinal damage in welders has been proposed to include a phototoxic reaction between visible light and phospholipids of retinal pigments, which generates reactive oxygen intermediates[14]. *Progressively might be* leading to the development of Pinguecula, Pterygium, corneal opacity, and pigmentary macular deposits among welders' eyes, which later leads to causing visual impairment (55).

This is also supported by another study that showed that working 8 hours per day, five days per week, was the maximum exposure limit recommended for welding workers. Workers with work targets tend to work beyond 8 hours or more than 5 days per week, thus becoming more susceptible to exposure to UV radiation and developing ocular injuries leading to visual impairment [18].

Conclusions

Based on the findings of this study, the visual impairment among welders was 29.34% (95% CI: 26.6-32.3%). Factors including the absence of training on eye personal protective equipment used, prolonged working hours per day, and not using eye personal protective equipment were considered risk factors for visual impairment.

Limitations of The Study

As the study design was cross-sectional, it was difficult to form a causal relationship between visual impairment and the associated factors. The other limitation of this study was that the study used only a Snellen chart for screening, which only diagnosed the status of the current visual status of the welders. So, it needs further investigation.

Recommendations

Based on our study, the following recommendations were made:

To Welders association: Training on the use of eye PPE should be improved through the education of welders. We encourage welders' associations to regularly check and enforce the availability of personal protective equipment at workers' places.

To Woreda administration, social and labor offices: We recommend that they have follow-up and support for regular visual assessment, working hours, and safety measures of welders.

To the Woreda health office: The need for regular eye checkups and utilization of ophthalmic eye care services should be emphasized to all welders.

To Future Researchers: Finally, we recommend that future researchers use different methodologies to determine the cause/effect relationship and degree of severity of VI by using an appropriate ophthalmic instrument like an Ophthalmoscope or Tonometer to check for visual impairment.

List of Abbreviations and Acronyms

- **AP**: Action Potential
- **OHS**: Occupational Health and Safety
- **ON**: Optic Nerve
- **PPE**: Personal Protective Equipment
- **PVA**: Presenting Visual Acuity
- **UVR**: Ultra Violet Rays
- **VA**: Visual Acuity
- **VI**: Visual Impairment

Statements and Declarations

Authors' Contributions

KRB: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Project Administration. MG: Supervision, Conceptualization, Methodology, Writing – Review & Editing. FS: Supervision, Conceptualization, Methodology, Writing – Review & Editing. KN: Methodology, Investigation, Validation, Writing – Review & Editing. WT: Investigation, Resources, Writing – Review & Editing.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

Availability of Data and Materials

The datasets generated and/or analysed during the current study are not publicly available due to ethical considerations related to participant confidentiality but are available from the corresponding authors on reasonable request.

Ethical Approval and Consent to Participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the

Institutional Ethics Review Board (IERB) of Gondar University (IERB No.1470/April/2022). Informed consent was obtained from all individual participants included in the study.

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