Research Article

# Prevalence of Visual Impairment and Ocular Disorders Among Brass Industry Workers in Moradabad, India: A Cross-Sectional Study

**Nagma Anwar[1], Md Mosaib Omaer[2*], Ruchika Sah[3], Parveen Anwar[1], Anam Ali[4]**

[1]Institute of Ophthalmology, Aligarh Muslim University, Aligarh, Uttar Pradesh, India
[2]Anwar eye care and vision therapy clinic, Moradabad, Uttar Pradesh, India
[3]Department of Optometry, Ramlal Golchha Eye Hospital Foundation, Biratnagar, Nepal
[4]Department of Optometry and Vision Science, C.L. Gupta Eye Institute, Moradabad, Uttar Pradesh, India

## Abstract

**Purpose:** To evaluate the visual status and ocular disorders among brass industry workers in Moradabad, Uttar Pradesh, India, focusing on the prevalence of visual impairment, refractive errors, and the usage of personal protective equipment (PPE).

**Methods:** A cross-sectional descriptive study was conducted in five small-scale brass industries in Moradabad, U.P, India. A total of 351 workers participated, with data collected on age, job roles, PPE usage, and ocular morbidity. Visual acuity was assessed using a Tumbling E chart for distance and Snellen's near vision chart. Refractive errors were identified through retinoscopy, and color vision was evaluated using Ishihara plates. Anterior segment abnormalities were checked with a flashlight examination. Data analysis was performed using SPSS software version 16.

**Result:** The mean age of participants was 38.5 years, with a significant male majority (93.16%). Among the participants, 8.26% had visual impairment (VI), with refractive errors (68.96%) and cataracts (24.14%) being the leading causes of VI. The prevalence of myopia, hypermetropia, and presbyopia was 23.36, 14.25, and 48.72%, respectively. Cataracts were noted in 10.54% of workers, while other ocular abnormalities included conjunctival and corneal disorders. Only 5.98% of workers reported using personal protective equipment (PPE), highlighting a significant gap in occupational safety practices.

**Conclusion:** The study underscores a high prevalence of uncorrected refractive errors, presbyopia, and cataracts among brass industry workers and low PPE usage. Targeted interventions, including vision screening, provision of corrective eyewear, and workplace safety improvements, are essential to mitigate occupational eye health risks in this vulnerable workforce.

**Keywords:** Occupational hazards, Brass industry, Visual impairment, Refractive errors, Ocular health, Personal protective equipment.

## Introduction

Occupational hazards, significantly contribute to disability and mortality rates among workers worldwide. These hazards are a leading factor in causing severe health issues and fatalities in the global workforce.[1,2] The brassware industry in India is predominantly situated in the North-Eastern region of Uttar Pradesh, with Moradabad district being a major hub. This district alone is responsible for producing 80% of the country's brassware and contributes to 75% of its exports.[3] Moradabad, a city in Uttar Pradesh, is famously known as "Peetal Nagri (City of Brass)", reflecting its status as a major hub for brass manufacturing and export. This vibrant industry is the backbone of the local economy, providing employment to thousands of workers involved in various stages of brass production.[4] However, the brass industry in Moradabad presents considerable health hazards, particularly respiratory and cardiovascular diseases, due to workers' exposure to tin, lead, and various chemical vapors throughout the manufacturing stages. These stages include ingot production, melting and casting, scraping, polishing, and welding.[5,6] Studies have highlighted that industrial environments, including mines, chemical plants, and petroleum industries,

**Address for correspondence:** Md Mosaib Omaer
Anwar eye care and vision therapy clinic, Moradabad, Uttar Pradesh, India
E-mail: mossab.opt@gmail.com



**How to cite this article:** Anwar N, Omaer MM, Sah R, Anwar P, Ali A. Prevalence of Visual Impairment and Ocular Disorders Among Brass Industry Workers in Moradabad, India: A Cross-Sectional Study. UP Journal of Ophthalmology. 2026;14(1): 1-6.
**Received:** 05-01-2026, **Accepted:** 20-02-2026, **Published:** 02-04-2026

UP JOURNAL OF OPHTHALMOLOGY
An Official Journal of Uttar Pradesh State Ophthalmological Society, UPSOS (Northern Ophthalmological Society, NOS)
p-ISSN: 2319-2062 | DOI: 10.56692/upjo.2026140101

are associated with high incidences of refractive errors, presbyopia, and other ocular disorders.[7-11] The brass industry, with its unique combination of metalworking and chemical exposure, presents a similar risk profile. Workers in these environments are subject to a variety of ocular hazards, including exposure to metal dust, chemical fumes, and physical eye strain from detailed craftsmanship. These factors can contribute to a higher prevalence of vision-related problems among these industrial workers compared to the general population.

Many of these hazards are preventable with adequate safety measures. One critical preventable issue is uncorrected refractive errors, which often lead to eye injuries in industrial settings.[7] Uncorrected vision problems can impair a worker's ability to perform tasks accurately, increasing the likelihood of accidents and reducing overall efficiency.

Despite the known risks, there is a paucity of studies specifically examining the visual and refractive status of workers in the brass industry, especially in the small-scale brass industries of Moradabad district. This study aims to fill this gap by detecting vision impairment and ocular disorders among brass industry workers in Moradabad.

## Materials And Methods

A cross-sectional descriptive study was conducted in five small-scale brass industries of Moradabad with written permission from industry officials and informed consent from participants, who were allowed to withdraw at any time. The institutional review board approved the study.

The examination team included a senior optometrist with over five years of experience and two junior optometrists with two years of experience. Data collected covered participants' age, job roles, use of personal protective equipment (PPE), and use of spectacles. Workers with less than one year of experience were excluded.

Visual acuity for distance was tested using a Tumbling E chart at 6 m. Participants with significant vision loss underwent further tests for finger counting, hand movements, light projection, and light perception. Visual acuity with current prescriptions was recorded for those wearing glasses. Subjects with distant visual acuity less than 6/6 were refracted with a retinoscope to identify refractive errors.

Near visual acuity was assessed using a Snellen near vision chart, and near correction was provided for those with acuity less than N8 to rule out presbyopia. Color vision was evaluated with Ishihara plates, and results were classified as normal or abnormal. A flashlight examination checked for anterior segment abnormalities, including the eyelids, sclera, conjunctiva, cornea, iris, and lens. The Hirschberg corneal reflex test and ocular movements were assessed using the broad H test with a flashlight.

### Study Definitions

In the current study, visual impairment (VI) is classified based on the WHO criteria with some modifications. Presenting visual acuity (PVA) in the better eye is categorized as follows: 6/12 or better as no VI, worse than 6/18 up to 6/60 is considered moderate visual impairment, worse than 6/18 up to 3/60 is classified as severe VI, and worse than 3/60 is defined as blindness.[12] Refractive error was defined based on the retinoscopy findings. Uncorrected presbyopia was defined as binocular near vision worse than N8 at the subject's customary working distance in individuals aged over 35 years.[13] Presbyopia was treated as a separate condition, as it affects near vision irrespective of a worker's myopic or hyperopic status. Cataract was defined as an opacity of the crystalline lens in the pupillary area, causing visual impairment (presenting visual acuity worse than 6/18 and not improving with pinhole).[14]

In cases where there was more than one cause of VI, the cause that was more easily treatable or correctable to achieve a visual acuity of 6/18 or better was considered the primary cause. For example, if an individual had both cataract and uncorrected refractive error, uncorrected refractive error was considered the primary cause of VI. All subjects were informed about the findings, and those with refractive errors such as myopia, hypermetropia, and presbyopia were provided with spectacles. Abnormal findings noted during the examination were referred to a higher center for further evaluation and management.

The data was entered into an MS Excel database (Microsoft Office 2007). Statistical Package for the Social Sciences (SPSS) software version 16 was used for data analysis. Results from the study were presented using descriptive and inferential statistics.

## Result

The study included a total of 351 workers (Table 1), with a significant majority being male (327 workers, representing 93.16%) and a smaller proportion being female (24 workers, representing 6.84%). The age distribution of the workers was as follows: 86 workers (24.50%) were aged between 19 and 28 years, 87 workers (24.79%) were aged between 29 and 38 years, 107 workers (30.48%) were aged between 39 and 48 years, 45 workers (12.83%) were aged between 49 and 58 years, 21 workers (5.98%) were aged between 59 and 68 years, and 5 workers (1.42%) were aged between 69 and 79 years.

### Prevalence of Visual Impairment

Table 3 shows distributions of the VI based on the WHO criteria for VI [12], the distribution of VI among the workers was as follows: 322 workers (91.73%) had no VI, 24 workers (6.84%) had mild to moderate VI, 5 workers (1.42%) was classified as having severe VI and none of the workers were came under blindness category. Of all the visually impaired subjects, 20 (68.96%) had refractive error, and 7 (24.14%) had cataract as a major cause of VI. Additionally, Table 4 shows the distribution of visually impaired workers with moderate and severe visual impairment (VI) across different occupational tasks. Among 29 workers with VI, 24 had moderate VI, while 5 had severe VI. Males constituted the majority (93.1%). The most frequently performed tasks were scraping (n=8),

**Table 1:** Distributions of workers according to age groups and gender

| | *Characteristics* | *Frequency (N)* | *Percentage (%)* |
|---|---|---|---|
| Gender | male | 327 | 93.16 |
| | female | 24 | 6.84 |
| Age (years) | 19-28 | 86 | 24.50 |
| | 29-38 | 87 | 24.79 |
| | 39-48 | 107 | 30.48 |
| | 49-58 | 45 | 12.83 |
| | 59-68 | 21 | 5.98 |
| | 69-79 | 5 | 1.42 |

**Table 2:** Distribution of Workers occupation

| *Occupation* | *Frequency (N)* | *Percentage (%)* |
|---|---|---|
| Scraping | 83 | 23.6 |
| Polishing | 65 | 18.5 |
| Packing | 44 | 12.5 |
| Embroidery | 31 | 8.8 |
| Welding | 25 | 7.1 |
| Rings creating | 23 | 6.6 |
| Casting | 22 | 6.3 |
| Brass repairing | 16 | 4.6 |
| Engraving | 12 | 3.4 |
| Lathing | 11 | 3.1 |
| Embosing | 9 | 2.6 |
| Manufacturing | 4 | 1.1 |
| Moulding | 4 | 1.1 |
| Administrative | 1 | 0.3 |
| Designing | 1 | 0.3 |

polishing (n=4), and engraving (n=3). Workers with severe VI were primarily involved in casting, engraving, and polishing.

## Refractive Error

Graph 1 illustrates refractive error distribution across age groups, focusing on emmetropia, myopia, and hyperopia. Emmetropia is most prevalent among younger individuals, with 67, 63, and 61 cases in the 19 to 28, 29 to 38, and 39 to 48 age groups, respectively, but it declines in older groups (12 cases in 49–58 and 6 in over 59). Myopia peaks in the 29 to 38 age group with 23 cases, decreasing in older groups. Hyperopia is rare in younger age groups but rises significantly with age, showing 22 cases in 39 to 48, 18 in 49 to 58, and 6 in over 59. This pattern indicates normal vision is common among the young, while farsightedness increases with age.

## Ocular Abnormalities

Table 5 shows ocular abnormalities among brass industry workers, which revealed that 62.39% had normal vision

**Table 3:** Distribution of visual impairment

| *Visual impairment (WHO Criteria)* | *Frequency (N)* | *Percentage (%)* |
|---|---|---|
| No VI | 322 | 91.73 |
| Moderate VI | 24 | 6.84 |
| SVI | 5 | 1.42 |

(emmetropia), while 23.36% suffered from myopia, 14.25% from hypermetropia, and 48.72% from presbyopia. Lid-related issues were rare, with ptosis and chalazion each affecting 0.28% of workers. Conjunctiva-related conditions included allergic eye disease (2.28%), pterygium (1.42%), and pinguecula (0.85%). Corneal conditions were corneal scars (1.42%) and degeneration (5.41%). Lens-related issues were significant, with cataracts in 10.54% of workers, pseudophakia in 0.85%, and aphakia in 0.28%. Additionally, 1.14% had squint, and 2.85% had color vision defects. The findings suggest that while a significant portion of the workforce has normal vision, there is a substantial prevalence of refractive errors, particularly presbyopia and myopia. Additionally, environmental and occupational factors appear to contribute to conjunctival, corneal, and lens-related conditions in brass industry workers.

## Use of Personal Protective Equipment (PPE)

The usage of personal protective equipment (PPE) among workers in the brass industry is detailed in Table 6. A small proportion of workers, 21 individuals (5.98%), reported using PPE, whereas the vast majority, 330 workers (94.02%), did not use any form of PPE.

Among those who used PPE, the types of equipment varied. Only 1 worker (4.76%) used black goggles, while plain goggles and protective goggles were each used by 10 workers (47.62% for each type), making up the total of 21 workers using PPE.

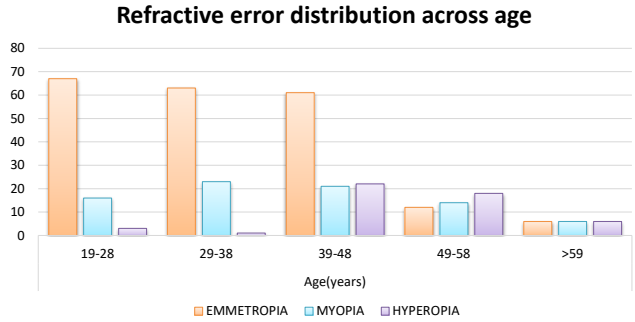
# Discussion

The current study was conducted as an initial exploratory investigation of the visual status of brass workers in Moradabad, Uttar Pradesh, India. The mean age of brass workers in our study is 38.5 years, which is slightly higher than the studies done on ocular morbidity in industrial workers, leather tannery workers and petroleum industry workers, which reported 35.3, 34.05 and 35.40 years, respectively, as mean age.[15-17] The greater mean age gives a hint of an aging workforce and may be due to the fact that the primary occupation of men involved is brass in the Moradabad district. So, brass is a lifetime career for the majority of them in the Moradabad district. The findings underscore the high prevalence of VI, notably 8.26% of the workers exhibited some form of VI, with refractive error and cataract being the primary causes. The VI reported in our study is quite high compared to previous research in similar industrial settings, which reported 6.3 and 4.1%, respectively.[7-8] The prevalence of VI in this study is notable given the demographic characteristics of the workers. Most

**Table 4:** Distribution of Visually Impaired Workers by Nature of Work

| *Category of VI* | *n* | *Gender (M/F)* | *Lat* | *Pac* | *BRep* | *Cas* | *Emb* | *Emr* | *Eng* | *Mol* | *Pol* | *RCre* | *Scr* | *Wel* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moderate VI | 24 | 23/1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 7 | 1 |
| Severe VI | 5 | 4/0 | - | - | - | - | 1 | - | 1 | - | 2 | - | 1 | - |
| Total | 29 | 27/1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 1 | 4 | 3 | 8 | 1 |
| Colour Blind | 10 | 10/0 | - | 1 | - | 1 | 1 | - | - | - | - | 1 | 4 | 2 |

Lat: Lathing; Pac: Packing; BRep: Brass repairing; Cas: Casting; Emb: Embossing; Emr: Embroidery; Eng: Engraving; Mol: Moulding; Pol: Polishing; RCre: Ring creation; Scr: Scrapping; Wel: Welding;




**Graph 1:** Proportion of refractive error according to age groups

**Table 5:** Shows the distributions of ocular abnormalities in brass industry

| | *Diagnosis* | *Frequency (N)* | *Percentage (%)* |
|---|---|---|---|
| | Emmetropia | 219 | 62.39 |
| | Myopia | 82 | 23.36 |
| | Hypermetropia | 50 | 14.25 |
| | Presbyopia | 171 | 48.72 |
| Lids related | Ptosis | 1 | 0.28 |
| | Chalazion | 1 | 0.28 |
| Conjunctiva related | Allergic eye disease | 8 | 2.28 |
| | Pterygium | 5 | 1.42 |
| | Pinguecula | 3 | 0.85 |
| Cornea related | Corneal scar | 5 | 1.42 |
| | Corneal degeneration | 19 | 5.41 |
| | Cataract | 37 | 10.54 |
| Lens related | Pseudophakia | 3 | 0.85 |
| | Aphakia | 1 | 0.28 |
| Other | Squint | 4 | 1.14 |
| | Color vision defect | 10 | 2.85 |

**Table 6:** Shows workers using PPE:

| | | *Frequency (N)* | *Percentage (%)* |
|---|---|---|---|
| PPE using | Yes | 21 | 5.98 |
| | NO | 330 | 94.02 |
| Type of PPE | Black goggles | 1 | 4.76 |
| | Plain goggles | 10 | 47.62 |
| | Protective goggles | 10 | 47.62 |
| | Total | 21 | 100 |

of the study participants were middle-aged, with a substantial portion falling within the 39 to 48-year age range. The study observed a significant correlation between age and refractive errors, with a high prevalence of myopia, 23.36%. Refractive error combined (myopia and hypermetropia) reported was 37.6%, which is higher than a study done on rubber industry, chemical and fertilizer, ship building and mine industry workers, which reported 12.4, 14.7 and 17.6% refractive error, respectively.[8] While refractive errors generally stabilize in adulthood,[18] our findings suggest that occupational factors, such as prolonged near work, exposure to metal dust, and uncorrected presbyopia, may contribute to changes in refractive status. Previous studies have indicated that early nuclear sclerosis and lenticular myopia can develop due to environmental influences, particularly in industrial settings.[19,20] Therefore, the observed shifts in refractive error are likely due to a combination of occupational and early age-related changes. High prevalence of uncorrected refractive errors suggests a lack of eyecare seeking behavior, which is further supported by the fact that of 132 workers found to have refractive error, only 10 workers were wearing their glasses. Uncorrected presbyopia was observed in 49% of the workers, which is lower than the previous study on metal machinery (small scale) industries, which reported 65% prevalence of uncorrected presbyopia.[21] The majority of the workers represent themselves at work without their glasses. Out of 171, only 4 were wearing their glasses. Not wearing presbyopic addition glasses can be detrimental to overall productivity. The impact of uncorrected presbyopia on occupational efficiency and safety in an industrial setting is concerning. Workers with uncorrected presbyopia experience difficulty in performing tasks that require precise near vision, increasing the risk of errors, accidents, and loss of productivity.[22] The study also highlights the limited use of personal protective equipment (PPE) among workers, with only 5.98% reporting regular use of any form of eye protection, which is consistent with the findings of a previous study.[15] This low utilization rate of PPE is alarming, considering the known benefits of protective eyewear in preventing occupational eye injuries.[23] Although none of the ocular conditions identified in this study are directly caused by chemical exposure, prolonged

occupational exposure to metal dust, UV radiation, and fine particulate matter can contribute to ocular surface conditions and visual fatigue. Protective eyewear can help mitigate these risks, especially for workers engaged in high-exposure tasks such as welding, polishing, and engraving. The low PPE utilization rate in our study highlights the need for increased awareness and accessibility to protective equipment in the brass industry. Strengthening occupational safety measures could significantly reduce preventable eye injuries and long-term visual impairment among these workers.

Additionally, the study observed various ocular abnormalities among the workers. Cataracts were notably prevalent, affecting 10.54% of the study population. This prevalence is higher than that reported among workers in the chemical (5.29%) and mining (7.4%) industries.[24,25] However, studies on welders and salt workers have reported even higher prevalence rates of 14.44% and 25.38%, respectively.[26,27] The lower cataract prevalence in our study may be due to a relatively healthier workforce and selection bias. Additionally, differences in cataract definition and grading across studies may account for discrepancies.[28] Pterygium was found in 1.42% workers, which is surprisingly much lower than reported by previous studies.[29,30] Color vision abnormalities (2.84%) found in our study are lower than the 10.8% reported in small-scale and tiny sector industries in Ambattur Industrial Estate, Chennai, India, but are similar to the 2% reported in small-scale and tiny sector metal machinery industries.[7,22] All individuals identified with color vision defectiveness were male. These color vision-deficient workers were primarily engaged in tasks such as packing (n=1), casting (n=1), embossing (n=1), polishing (n=1), scraping (n=4), and welding (n=2). No color vision defect workers were found in lathing, brass repairing, embroidery, engraving, molding, or ring creating. Defective color vision can reduce work efficiency and increase the risk of workplace accidents. Therefore, future research should focus on the impact of color vision defectiveness on the functioning of industry workers.

Despite these significant findings, the study has several limitations. The cross-sectional design provides a snapshot of the ocular health status of workers at a single point in time, which may not capture the progression of VI and ocular disorders over time. Additionally, the reliance on self-reported data for PPE usage may introduce reporting bias. Future longitudinal studies are needed to establish causal relationships between occupational exposures and ocular health outcomes and to evaluate the effectiveness of interventions aimed at improving eye health in this population.

## Conclusion

The study reveals significant ocular health issues among brass industry workers in Moradabad, highlighting a high prevalence of visual impairment, uncorrected refractive errors, and uncorrected presbyopia. The findings emphasize the urgent need for regular vision screening, the provision of affordable corrective eyewear, and the implementation of comprehensive eye care services. Additionally, the low usage of personal protective equipment calls for increased awareness and accessibility to enhance worker safety. Addressing these concerns can substantially improve the ocular health, safety, and overall productivity of workers in the brass industry. Future research should focus on longitudinal studies to better understand the progression of ocular disorders and the effectiveness of preventive interventions.

## References


1. International Labor Organization. Safety in Numbers: Pointers for Global Safety Culture at Work. Geneva: International Labor Organization; 2003. Available from: http://www.ilo.org/public/english/region/eurpro/moscow/areas/safety/docs/safety_in_numbers_en.pdf.
2. World Health Organization. Environment, Health and Sustainable Development. Geneva: World Health Organization; 1997.
3. Sajid M. Export Potentialities of Brassware Industry of U. P. Department of Commerce, Aligarh Muslim University, Aligarh (India)]; 1992 [cited 2024 May 20]. p. 107–48. Available from: https://core.ac.uk/download/pdf/144509283.pdf
4. Kumar A, Sahu N, Batar AK. Chapter: Environmental implications of brass industry in Moradabad City, Uttar Pradesh. In: Anand S, editor. Progress in Environmental Management: Indian Experiences Edition. New Delhi, India: Research India Press Editors; 2013. pp. 121–38.
5. Garg R, Matreja PS, Maqusood M. Analysis of lung function and respiratory symptoms in brass/metal industrial workers of Moradabad, Uttar Pradesh, India. Ann Afr Med. 2023 Apr-Jun;22(2):219-223. doi: 10.4103/aam.aam_24_22. PMID: 37026203; PMCID: PMC10262865.
6. Lison D. Human toxicity of cobalt-containing dust and experimental studies on the mechanism of interstitial lung disease (hard metal disease). Crit Rev Toxicol. 1996 Nov;26(6):585-616. doi: 10.3109/10408449609037478. PMID: 8958466.
7. Janarthanan SD, Vasanth J, Reddy A, Chaudhry M. Visual profile of the small-scale industry workers at the Ambattur industrial Estate, Chennai. J Clin Exp Ophthalmol. 2017;8(6):2.
8. Parulekar P, Naik PG, Perni SG, Vaz FS. Prevalence of ocular morbidity amongst industrial workers in Goa, India. Int J Recent Adv Multidiscip Res. 2015;2:0298-300.
9. Omoti AE, Waziri-Erameh JM, Enock ME. Ocular disorders in a petroleum industry in Nigeria. Eye (Lond). 2008;22(7):925-9.
10. Ovenseri-Ogbomo GO, Ocansey S, Abu EK, Kyei S, Boadi-Kusi SB. Oculo-visual findings among industrial mine workers at Goldfields Ghana Limited, Tarkwa. Ophthalmol Eye Dis. 2012;4:3-7.
11. Abiose A, Otache MA. Ocular health status of Nigerian industrial workers. The Journal of Tropical Medicine and Hygiene. 1980 Jun 1;83(3):105-8.
12. World Health Organization. International Classification of Diseases 11th Revision (ICD-11) – Visual Impairment. 2024 [cited 2024 Feb 4]. Available from: https://icd.who.int/browse/2024-01/mms/en#1103667651
13. Marmamula S, Keeffe JE, Rao GN. Uncorrected refractive errors, presbyopia and spectacle coverage: results from a rapid assessment of refractive error survey. Ophthalmic Epidemiol. 2009;16(5):269-74.

14. Marmamula S, Ravuri CS, Boon MY, Khanna RC. A cross-sectional study of visual impairment in elderly population in residential care in the South Indian state of Andhra Pradesh: a cross-sectional study. BMJ Open. 2013;3(3):e002576.
15. Titiyal JS, Murthy GV. Industrial ocular morbidity in a north Indian town. Indian J Public Health. 1998;42(2):29-33.
16. Gupta RC, Ranjan R, Kushwaha RN, Khan P, Mohan S. A questionnaire-based survey of dry eye disease among leather tannery workers in Kanpur, India: a case-control study. Cutaneous and ocular toxicology. 2014 Dec 1;33(4):265-9.
17. Ram MS, Majumder C. Incidence of eye disorders in petroleum industry of central India: A prospective study. Annals of Health and Health Sciences. 2017;4(1):35.
18. Weale RA. Epidemiology of refractive errors and presbyopia. Survey of ophthalmology. 2003 Sep 1;48(5):515-43
19. Frick KD, Joy SM, Wilson DA, Naidoo KS, Holden BA. The global burden of potential productivity loss from uncorrected presbyopia. Ophthalmology. 2015 Aug;122(8):1706-10.
20. Krishnaiah S, Srinivas M, Khanna RC, Rao GN. Prevalence and risk factors for refractive errors in the South Indian adult population: The Andhra Pradesh Eye disease study. Clinical Ophthalmology. 2009 Jun 2:17-27.
21. Iwundu CN, Yin C, Coleman AL, Hansen J, Kwon J, Heck JE. Occupational exposures and age-related cataract: A review. Archives of Environmental & Occupational Health. 2025 Jan 17:1-0.
22. Kalaria K, Shah H, Satani D, Desai T. Assessment of general ocular health and visual status of the small-scale industrial workers. Indian J Appl Basic Med Sci. 2021 Aug 25;23(37):182-200.
23. AlMahmoud T, Elkonaisi I, Grivna M, AlNuaimi G, Abu-Zidan FM. Eye injuries and related risk factors among workers in small-scale industrial enterprises. Ophthalmic Epidemiol. 2020 Nov;27(6):453-9.
24. Patel PK, Sah SK, Adhikari PR, Karn RR. Prevalence of ocular morbidity among industrial workers of Eastern Nepal. IHOPE J Ophthalmol. 2024;3:10-5. Doi: 10.25259/IHOPEJO_25_2023.
25. Ovenseri-Ogbomo GO, Ocansey S, Abu EK, Kyei S, Boadi-Kusi SB. Oculo-visual findings among industrial mine workers at Goldfields Ghana Limited, Tarkwa. Ophthalmol Eye Dis. 2012;4: OED-S9204.
26. Manoher JM, Kumar A. Prevalence and pattern of ocular disorders due to chronic exposure to arc welding among occupational welders in Western Rajasthan. Journal of Family Medicine and Primary Care. 2022 Jun 1;11(6):2620-6.
27. Cherian J, Singh Z, Bazroy J, jacob Purty A, Natesan M, kantilal Chavada V. Study of morbidity pattern among salt workers in Marakkanam, Tamil Nadu, India. Journal of Clinical and Diagnostic Research: JCDR. 2015 Apr;9(4):LC01.
28. Asbell PA, Dualan I, Mindel J, Brocks D, Ahmad M, Epstein S. Age-related cataract. Lancet. 2005 Feb 12;365(9459):599-609.
29. Davies KG, Asana U, Nku CO, Osim EE. Ocular effects of chronic exposure to welding light on Calabar welders. Niger J Physiol Sci. 2007;22(1-2):55-8.
30. Doughty MJ, Oblak E. A clinical assessment of the anterior eye in arc welders. Clin Exp Optom. 2005 Nov;88(6):387-95.