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Original Research Article

Visual health burden among industrial workers in Noida, India: an epidemiological study

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ABSTRACT

Background: To assess the prevalence, risk factors, and impact of visual health issues among industrial workers in Noida, India,
Methods: This study employed a cross-sectional design to assess the ocular health burden among industrial workers in Noida, India. Data collection included structured questionnaires, vision screening tests, and comprehensive ocular examinations conducted by trained optometrist. The questionnaires gathered information on demographics, occupational exposure, visual symptoms, and eye care practices. Vision screening included tests for visual acuity, refractive errors, slit-lamp assessments, and fundus examination.
Results: A total of 638 industrial workers attended the eye camp, with 279 (43.73%) having normal vision and 359 (56.26%) experiencing eye problem. Refractive error (25.91%) was the most common ocular issue, followed by presbyopia (12.81%) and cataract (8.64%). The construction industry had the highest prevalence (31.48%), followed by rubber/plastic (12.81%) and textiles (12.26%).
Conclusions: The study indicates a high prevalence of ocular morbidity, likely influenced by workplace hazards such as dust, chemical exposure, poor lighting, and prolonged screen use. Addressing these concerns through regular vision screenings, workplace safety measures, and awareness programs is crucial.

Keyword: Ocular health, Industries, Workers, India, Prevalence

INTRODUCTION

Ocular health refers to the overall well-being of the eyes, including their function, structure, and ability to provide clear vision. Various factors, such as age, lifestyle, environmental conditions, and occupational hazards, can impact vision and contribute to eye-related disorders. Globally, 246 million people suffer from vision impairments, including 39 million who are blind.[1] Notably, around 80% of visual impairments are preventable, treatable, or curable. Approximately 90% of blind individuals worldwide reside in underdeveloped nations, where ocular morbidities pose a significant public health concern.[2]

Industrial workers in India play a crucial role in the country's economic growth, yet their occupational environment poses significant risks to their eye health. The Noida industrial area, one of the largest industrial zones in northern India, houses a diverse range of industries, including manufacturing, electronics, textiles, automobiles, metalworking, plastics, and packaging. This thriving industrial hub serves as a major employment center, providing livelihoods to thousands of workers engaged in production, assembly, fabrication, and heavy

machinery operations.[3] However, the demanding nature of industrial work exposes workers to multiple occupational hazards, such as continuous dust exposure, hazardous chemicals, extreme temperatures, intense screen use, prolonged working hours, and poor ventilation. These factors significantly increase the risk of various health issues, including respiratory disorders, musculoskeletal problems, and ocular morbidity which manifests as refractive errors, dry eye syndrome, ocular allergies, and cataracts. Though the startling reality is that practically all job-related eye injuries are avoidable, the impact on the person who loses eyesight in a work accident is catastrophic.[4] It is possible to prevent 90% of eye injuries with the right information and usage of eye protection.[5]

Ocular morbidity and visual impairments are prevalent among industrial workers in India; however, specific data on their exact prevalence remains limited. Studies suggest that the prevalence of ocular morbidity ranges from 20% to 90%.[6-8] A study conducted among migrant sugar factory workers in Maharashtra reported high prevalence of refractive errors (23%) and cataracts (11%).[9] Similarly, Parulekar et al found 32.1% ocular morbidity among industrial workers across three industries in Goa.[10] In Puducherry, a study by Lulla et al identified refractive errors as the most common ocular condition, followed by cataracts.[11] In Nepal, a study by Adhikari et al on industrial workers in Patan Industrial Estate found that 36.7% of workers had eye-related issues.[12] Meanwhile, research conducted in Nigeria reported ocular disorders in 66.4% of examined eyes, with pinguecula (21.5%) being the most common condition.[13]

Awareness regarding the use of personal protective equipment (PPE) and ocular safety devices in the workplace is reported to be very low, contributing to an increased risk of ocular morbidity.[14-16] The rising prevalence of ocular conditions among industrial workers underscores the urgent need for workplace safety measures, regular eye health screenings, and preventive interventions to protect their well-being. The primary objective of this study is to determine the prevalence of ocular morbidity among industrial workers in the Noida Industrial Area, one of the largest industrial zones in northern India.

METHODS

This is a cross-sectional study conducted in Noida, India. Noida (New Okhla industrial development authority) is a planned city in the Gautam Buddha Nagar district of Uttar Pradesh, India. The study was conducted over a period of three months, from November 2024 to January 2025. A random sampling technique was employed to ensure a representative sample of industrial workers across different sectors in Noida. Industries were first categorized into strata based on industry type (e. g., manufacturing, textiles, electronics, construction). Then, industries and workers were randomly chosen from each group to ensure fair representation. An eye camp was organized in various sectors of Noida, and industry supervisors were informed about the camp. The inclusion criteria for the study comprised industrial workers aged above 15 years who had been employed at their current workplace for at least six months and were willing to provide informed consent to participate. The exclusion criteria included workers with pre-existing diagnosed eye conditions unrelated to occupational exposure, those who had recently undergone ocular surgery or experienced eye trauma not associated with their work environment, and individuals unwilling to participate in the study. Informed consent was obtained from all participants.

The entire participants were examined by the experienced optometrist and optometry student. A semi-structured questionnaire was prepared for the investigation. The questionnaires were offered in the region's primary languages, English and Hindi. A prepared questionnaire was used to conduct interviews with each respondent. The questionnaire covered information regarding the workers age, sex, and chief eye-related complaints, any history of ocular trauma, workplace characteristics, and use of any PPE. The entire participant underwent an ophthalmic examination, which included visual acuity testing, objective and subjective refraction, slit lamp examination, cover test, dry eye assessment, and fundus examination with the help of direct ophthalmoscope. Visual acuity was measured using Snellen charts for both distance and near vision. Objective refraction was performed with a retinoscope under dim illumination, followed by subjective refraction. Anterior segment examination was done with a portable slit lamp, and the ocular adnexa were examined with the help of torchlight. The Hirschberg corneal reflex test and the cover test were used to measure binocularity for both near and distance. The Schirmer test was conducted for the diagnosis of dry eye. Participants with conditions such as cataracts, glaucoma, retinal detachment, diabetic retinopathy, or those requiring surgery were advised to visit a nearby hospital for further management.

Data analysis

The total number of reported cases of ocular morbidity divided by the total number of study participants, multiplied by 100, was used to calculate the prevalence of ocular morbidity. Similarly, the number of reported cases of independent ocular morbidity divided by the total number of reported cases of ocular morbidity, multiplied by 100, was used to calculate the prevalence of each independent ocular morbidity.[17] The data was coded, decoded, and statistically analyzed using MS excel and IBM SPSS 20.

RESULTS

A total of 638 industry worker attended the eye camp for their eye checkup. Among them, 511 participants (80.09%) were male, while 127 participants (19.91%)

were female (Table 1). The distribution of presenting visual acuity among the study participants indicates that out of 638 individuals, 279 (43.73%) had normal vision (6/6). Total of 164 participants (25.71%) had mild visual impairment with visual acuity ranging from 6/9 to 6/12, while 103 (16.14%) had moderate impairment (6/18 to 6/60). Additionally, 92 participants (14.42%) had severe visual impairment with vision worse than 6/60 (Table 2).

The study included a total of participants across various age groups, with the highest representation in the 41-50 years category, comprising 167 individuals (26.18%). This was followed by the 31-40 years group, which accounted for 131 participants (20.53%), and the 21-30 years group with 123 participants (19.28%). The 51-60 years category included 86 participants (13.48%), while the youngest age group, 15-20 years, had 67 participants (10.50%). The least represented group was those above 60 years, with 64 participants (10.03%) (Table 3).

The study found refractive error to be the most common ocular morbidity (25.91%), followed by presbyopia (12.81%) and cataract (8.64%). Other prevalent conditions included pseudophakia (7.52%), ocular allergy (6.69%), pinguecula (5.85%), and pterygium (5.29%). Less common issues were amblyopia (4.46%), corneal scars and diabetic retinopathy (each 3.90%), optic atrophy and blepharitis (each 3.62%), and squint (3.06%). Rare cases included anophthalmic eye (0.84%), Age related macular degeneration (ARMD) (1.95%), retinal detachment (1.39%), and xerophthalmia (0.56%) (Figure 1). Ocular morbidity was most prevalent in the construction industry (31.48%), followed by the rubber and plastic (12.81%) and textile and garment sectors (12.26%) while woodworking and carpentry had the lowest prevalence (6.41%) (Figure 2).

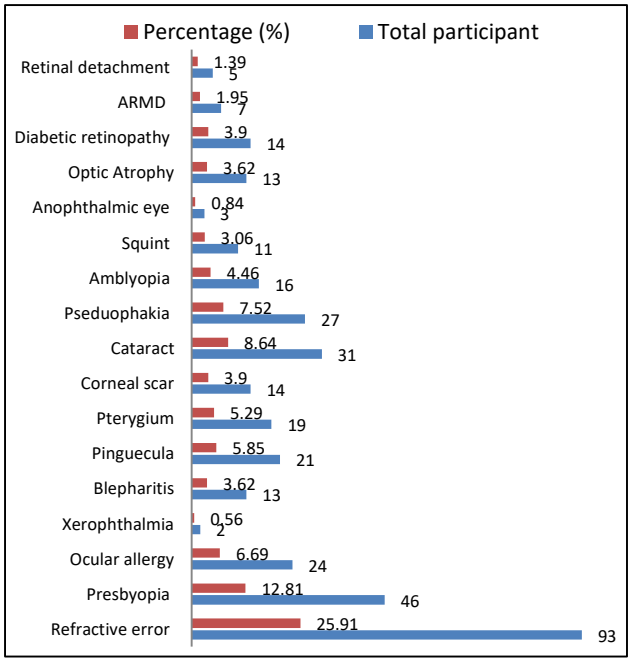

Figure 1: Distribution of ocular morbidity.

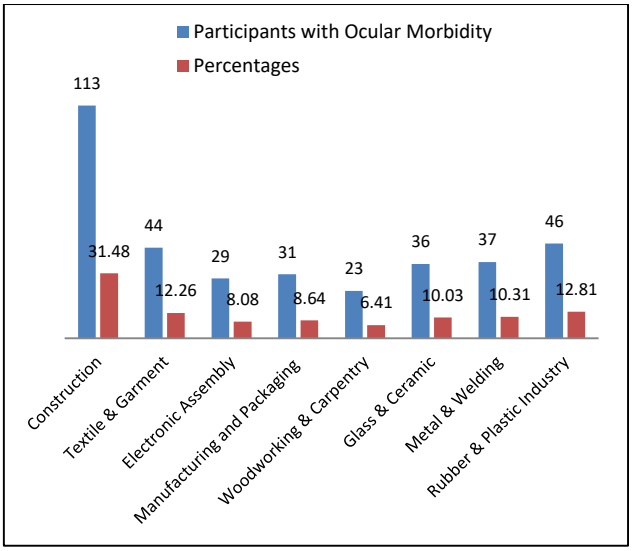

Figure 2: Industry wise distribution of ocular morbidity.

Table 1: Gender distribution.

Gender	Total participant	Percentage (%)
Male	511	80.09
Female	127	19.91
Total	638	100

Table 2: Distribution presenting visual acuity.

Visual acuity	Presenting visual acuity	Percentage (%)
6/6	279	43.73
6/9-6/12	164	25.71
6/18-6/60	103	16.14
<6/60	92	14.42
Total	638	100

Table 3: Age distribution.

Age group (in years)	Total participant	Percentage (%)
15-20	67	10.50
21-30	123	19.28
31-40	131	20.53
41-50	167	26.18
51-60	86	13.48
Above 60	64	10.03
Total	638	100

DISCUSSION

Early detection and treatment of ocular morbidity require regular eye examinations and screenings for industrial workers. In our study, we found that the prevalence of ocular morbidity in industrial workers is 56.26%, which is similar to the study conducted by Omoti et al which reported a prevalence of 66.4%.[13] A study conducted in Goa, India, found that the prevalence was 34.6% in the

chemical and fertilizer industry, 37.6% in the shipbuilding industry, and 24.3% in the rubber industry.[10] The study conducted by Okoye found that 81.7% of workers had ocular disorders, which is higher than our study.[18] This difference may be due to variations in the types of industries studied, as Okoye's study included cement, coal, vehicle repair, and timber factories.

In our study, the most common ocular morbidity was refractive error (25.91%), which is similar to the findings of Rezayee et al in Bangladesh (26.4%) and Bangal et al (23%) in a sugar factory.[9,19] Omoti et al found that the most common ocular morbidity in Nigeria was pinguecula.[13] This may be due to differences in the types of industries studied and the climatic conditions of Nigeria, as it is a hot country with higher exposure to UV light. In our study prevenance of pinguecula is 5.85%. In our study, the prevalence of cataract was 8.64%. However, the prevalence rates reported by Baldev et al and Pisudde et al were 36.1% and 36.3%, respectively.[20,21] This disparity can be attributed to the fact that both studies included individuals above the age of fifty. Ocular allergy (6.69%) and pterygium (5.29%) were common among workers, potentially due to chronic exposure to airborne irritants, pollutants, and UV radiation. These findings suggest that personal protective measures, including the use of protective eyewear and improved workplace ventilation, should be emphasized to reduce ocular surface disorders in industrial settings. Our study found retinal disorder such as diabetic retinopathy (3.90%) and age-related macular degeneration (ARMD) in 1.95%, which is consistent with research by Pranesh et al and Baldev et al.[20,22]

Workers in the construction industry had the highest prevalence (31.48%), likely due to high levels of dust, debris, and physical hazards, which increase the risk of eye injuries and surface disorders. The rubber and plastic (12.81%) and textile and garment (12.26%) industries also demonstrated considerable ocular morbidity, possibly due to prolonged exposure to airborne fibers, chemicals, and poor ergonomic conditions. Islam et al observed an incidence rate of 168.3 ocular injuries per 100,000 workers, whereas Titiyal et al found a 10% frequency of industrial ocular injuries in their study of six industrial enterprises in North India.[23,24] These findings emphasize the need for targeted occupational health interventions, including regular eye screenings, improved workplace safety regulations, and worker education on eye protection. Employers should be encouraged to implement comprehensive eye health programs and provide access to corrective eyewear and protective equipment to mitigate the visual health burden among industrial workers.

Limitations

The sample size may not be large or diverse enough to represent the broader industrial workforce in Noida, which affects the generalizability of the results. This cross-sectional study captures data at a single point in time, limiting the ability to establish causal relationships between occupational factors and ocular health issues. Participants might have underreported or over reported their symptoms due to memory recall issues or social desirability bias.

CONCLUSION

The study indicates a high prevalence of ocular morbidity, likely influenced by workplace hazards such as dust, chemical exposure, poor lighting, and prolonged screen use. Addressing these concerns through regular vision screenings, workplace safety measures, and awareness programs is crucial.

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