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Assessment of Vision Impairments among Licensed Drivers in Mathura: A Pilot Study

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ABSTRACT

Background: Driving is a visually intensive task that requires the integration of multiple visual functions to ensure road safety. In India, vision screening protocols for obtaining a driving license are often inadequate or inconsistently enforced. This pilot study was conducted to assess the prevalence and types of vision impairments among licensed drivers in Mathura district.

Objective: To evaluate key visual parameters-glare recovery, night vision, colour vision, visual acuity, phoria, and horizontal visual field-among licensed male drivers and determine their potential impact on driving performance.

Methods: A cross-sectional pilot study was conducted at Spexwear Optical & Physiotherapy Centre, Mathura.. A total of 198 male drivers aged 18–56 years participated. Standardized tests were conducted to assess visual acuity (Snellen chart), colour vision (Ishihara plates), glare recovery, night vision, phoria, and horizontal field of vision. Data were analysed using descriptive statistics and chi-square tests; p-values < 0.05 were considered statistically significant.

Results: Visual acuity deficits were noted in 29% of participants (binocular), 33% (right eye), and 25% (left eye). Impairments in glare recovery and night vision were present in 12% and 8% of drivers, respectively. Color vision deficiency was found in 23% of participants, with an additional 13% requiring retesting. Phoria was abnormal in 24%, and 19–20% of drivers showed subnormal horizontal field vision in at least one eye. Most impairments showed statistically significant associations ($p < 0.05$) with driving fitness.

Conclusion: A significant proportion of licensed drivers in Mathura have unrecognized visual impairments. Comprehensive vision screening should be made mandatory in the driver licensing process to enhance road safety and reduce accident risks.

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Introduction

Driving is a complex visual-motor activity that relies heavily on the efficiency of the human visual system. Vision, as one of the most critical sensory functions, contributes to more than 90% of the sensory input required for safe driving. The human eye is a sophisticated organ that detects, interprets, and processes visual information from the environment, which is subsequently relayed to the brain for higher-order interpretation. The visual system encompasses not only the mechanical and neural components of the eye itself but also its dynamic interactions with the brain, enabling humans to detect motion, perceive depth, distinguish colours, identify hazards, and make real-time driving decisions [1].

A typical driver relies on a wide visual field, sharp visual acuity, accurate depth perception, effective night vision, and rapid glare recovery to make safe and effective decisions on the road. The visual field of a human encompasses approximately 180 to 200 degrees horizontally and about 135 degrees vertically. Central vision is used for reading signs and detecting details, while peripheral vision helps monitor surrounding traffic and potential threats. When any of these visual functions are compromised, the ability to safely operate a vehicle is reduced, thereby increasing the risk of accidents and endangering both the driver and the public [2].

Color vision is a key component of driving as it enables individuals to identify traffic signals, warning signs, and vehicle indicators. The retina contains cone photoreceptors, each sensitive to different wavelengths of light-short (blue), medium (green), and long (red). Deficiencies in any of these cone types can impair colour perception, potentially resulting in misinterpretation of traffic lights or hazard warnings. While many individuals with mild colour vision deficiencies can compensate through learning and habit, others may face significant challenges in dynamic environments like busy intersections or poorly lit roads [3].

Night vision and glare recovery are additional visual functions vital for driving, particularly in countries like India where street lighting is inconsistent, and many roads are poorly illuminated. Night blindness (nyctalopia) results from reduced rod function in low-light conditions, limiting a driver's ability to detect pedestrians, road edges, or oncoming vehicles. Glare, often caused by headlights or reflective surfaces, can temporarily blind a driver, and the ability to recover quickly is crucial. Slow glare recovery can make it difficult for drivers to regain clear vision after exposure to high-beam headlights or sunlight, significantly increasing the risk of collisions [3].

Another important visual function is phoria, a latent tendency for eye misalignment. While phoria may not present symptoms under normal conditions, it can become problematic during sustained visual tasks like driving, especially when fatigued. Misalignment can cause diplopia (double vision), eye strain, or headaches, compromising a driver's focus and reaction time. The horizontal visual field is equally critical, as it allows for detection of vehicles, pedestrians, and obstacles from the side. A constricted visual field can result in "tunnel vision," reducing a driver's ability to anticipate and respond to peripheral hazards [4].

In India, the licensing system under the Motor Vehicles Act (1988) requires minimal vision testing, often limited to basic Snellen chart assessments. Unlike developed countries, where stringent visual standards are enforced for license issuance and renewal, India lacks a robust framework to identify and restrict drivers with visual impairments. Several studies conducted across Indian cities have indicated that many drivers either bypass mandatory vision assessments or obtain licenses without any vision screening. The consequences of this oversight are evident in the high incidence of road traffic accidents, a significant proportion of which are attributed to human error, including impaired vision [5].

With road safety emerging as a national priority under the Road Safety Vision 2020 and the subsequent 2021–2030 action plan, the need for comprehensive vision screening as part of the driver licensing process has become increasingly urgent. Vision impairments, if undetected or uncorrected, pose a major threat to traffic safety, particularly in densely populated urban areas like Mathura. This pilot study seeks to bridge the existing knowledge gap by evaluating key visual parameters among drivers in mathura and highlighting their potential impact on driving competence. By systematically assessing visual acuity, color vision, glare recovery, night vision, phoria, and horizontal visual fields, the study aims to provide evidence-based recommendations to inform licensing policies and promote road safety [6].

Materials and Methods

This cross-sectional pilot study was conducted to evaluate the prevalence and patterns of vision impairments among licensed male drivers in Mathura, India. The research was carried out at **Spex wear Optical & Physiotherapy Centre, Mathura**, over a period of twelve months, from August 2023 to August 2024. The clinic serves a diverse urban population and is equipped with standard ophthalmic diagnostic instruments required for visual function assessments.

A total of 250 drivers were initially approached, out of which 198 met the eligibility criteria and completed the full set of vision tests. All participants were male, aged between 18 and 56 years, and held valid Indian driving licenses. They were actively employed as drivers or conductors of private or commercial vehicles. The study did not limit inclusion based on educational qualification or socioeconomic status. However, individuals below 18 years of age, those with any known ocular diseases or systemic conditions affecting vision, individuals who used spectacles or contact lenses, or those with a history of ocular surgery were excluded from participation.

Prior to data collection, each participant was provided with detailed information about the objectives and procedures of the study, and informed written consent was obtained. Ethical clearance was secured from the institutional ethics committee, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Participant confidentiality and anonymity were strictly maintained.

All participants underwent a comprehensive series of visual tests under standardized lighting conditions, conducted by trained optometrists. Visual acuity was measured using the standard Snellen chart at a 6-meter distance, with separate readings recorded for the right eye, left eye, and both eyes combined. Color vision was evaluated using Ishihara pseudoisochromatic plates to detect red-green color deficiencies. Night vision was assessed under simulated low-illumination conditions to evaluate scotopic visual capacity, while glare recovery was tested by exposing the participant to a strong light source and measuring the time taken to identify visual targets post-exposure. Phoria testing was performed using the Maddox rod and cover–uncover test to assess latent ocular misalignment. The horizontal visual field was measured using both confrontation method and Goldmann perimetry to estimate the peripheral field range in each eye.

Performance on each test was graded using standardized criteria. For most tests, results were categorized as normal, unsuccessful, or requiring retest. For the glare and night vision tests, a 10-point scale was used to classify the level of performance ranging from outstanding to poor. Visual acuity was considered normal if the best-corrected vision was 6/6 to 6/9, unsuccessful if worse than 6/12, and retest was suggested for cases where responses were inconsistent or inconclusive.

All data were recorded in Microsoft Excel 2019, reviewed for completeness and consistency, and analysed descriptively. Frequency distributions and percentages were calculated to summarize participant performance in each visual domain. Graphical representations such as bar charts and pie diagrams were created to illustrate categorical distributions. As the study was exploratory in nature, no inferential statistical tests were applied. Statistical analyses were performed using SPSS software, version 21 (IBM Corp., Armonk, NY, USA).

Results

A total of 198 male drivers between the ages of 18 and 56 years were assessed for various visual parameters, including glare recovery, night vision, color vision, visual acuity (right eye, left eye, and binocular), phoria, and horizontal visual fields. The outcomes of each test are summarized in the following subsections with corresponding tables and statistical significance (p-values) where applicable.

Glare Recovery Test

The glare recovery test results showed that 20% of drivers performed at a good level, 15% were reasonably good, and another 15% were only satisfactory. Notably, 7% of drivers exhibited below-average performance and 5% had poor glare recovery, indicating significant impairment in visual adaptation following exposure to bright lights ($p = 0.042$).

Table 1: Glare Recovery Test

S. No	Grade	Number of Drivers	Percentage (%)	P value
1	Outstanding (10)	8	4%	= 0.042
2	Excellent (9)	9	5%	
3	Very Good (8)	41	20%	
4	Good (7)	40	20%	
5	Reasonably Good (6)	30	15%	
6	Satisfactory (5)	29	15%	
7	Above Average (4)	9	5%	
8	Average (3)	8	4%	
9	Below Average (2)	14	7%	
10	Poor (1)	10	5%	

Night Vision Test

In the night vision assessment, 28% of drivers achieved a very good score, and 20% scored good. However, 12% performed only at a satisfactory level, while 6% were below average and 2% performed poorly (p = 0.031).

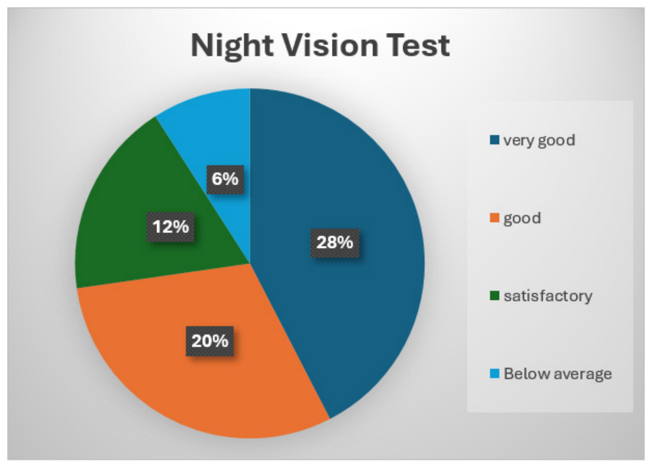

Figure 1: Night Vision Test

Night Vision Test

In the night vision assessment, 28% of drivers achieved a very good score, and 20% scored good. However, 12% performed only at a satisfactory level, while 6% were below average and 2% performed poorly. These results suggest that although the majority of drivers had adequate night vision, a minority could be at risk when driving under low-light conditions (p = 0.031).

Table 2: Night Vision Test

S. No	Grade	Number of Drivers	Percentage (%)	P value
1	Outstanding (10)	9	5%	= 0.031
2	Excellent (9)	16	8%	
3	Very Good (8)	55	28%	
4	Good (7)	39	20%	
5	Reasonably Good (6)	19	10%	
6	Satisfactory (5)	23	12%	
7	Above Average (4)	10	5%	
8	Average (3)	8	4%	
9	Below Average (2)	11	6%	
10	Poor (1)	5	2%	

Color Vision Test

The color vision test showed that 23% of drivers failed the test, and 13% required retesting. Only 64% had normal color vision. This implies a significant proportion of drivers may struggle to distinguish signal lights or road signs (p = 0.019).

Table 3: Color Vision Test

S. No	Grade	Number of Drivers	Percentage (%)	P value
1	Normal	125	64%	= 0.019
2	Unsuccessful	46	23%	
3	Retest Needed	27	13%	

Visual Acuity Test

The evaluation of visual acuity across right eye, left eye, and both eyes revealed significant findings. For binocular vision, 29% of participants were unsuccessful, and 10% required retesting. Monocularly, the right eye showed a higher failure rate (33%), while the left eye showed 25% failure. These impairments could significantly hinder drivers' ability to perceive road hazards, signs, and pedestrians clearly, thus posing safety risks ($p = 0.027$).

Table 4: Visual Acuity Test

S. No	Grade	Right Eye (n)	Left Eye (n)	Both Eyes (n)	Right Eye (%)	Left Eye (%)	Both Eyes (%)	P value
1	Normal	110	128	120	56%	65%	61%	=0.027
2	Unsuccessful	66	50	59	33%	25%	30%	
3	Retest Needed	22	20	19	11%	10%	9%	

Phoria Test

Phoria testing showed that 24% of the drivers had phoria-related issues, and 7% required retesting. A total of 69% showed normal results. Abnormal phoria can impact depth perception and eye coordination, which are critical for driving ($p = 0.022$).

Table 5: Phoria Test

S. No	Grade	Number of Drivers	Percentage (%)	P value
1	Normal	136	69%	=0.022
2	Unsuccessful	47	24%	
3	Retest Needed	15	7%	

Horizontal Visual Field Test

Horizontal field testing revealed that 78% of drivers had normal vision in the left eye and 77% in the right eye. About 19% and 20% failed in the left and right eyes respectively, while 3% in both required retesting. A reduced horizontal field could impair a driver's ability to detect peripheral hazards, posing a serious safety risk ($p = 0.018$).

Table 6: Horizontal Visual Field Test

Eye Side	Normal (n, %)	Unsuccessful (n, %)	Retest Needed (n, %)	P value
Left	154 (78%)	38 (19%)	6 (3%)	= 0.018
Right	152 (77%)	40 (20%)	6 (3%)	

Discussion

Driving is a complex visuomotor task that heavily depends on the proper functioning of various visual faculties including visual acuity, glare recovery, night vision, color perception, depth perception, and peripheral vision. Inadequate visual performance in any of these domains can critically impair driving ability and compromise road safety. This pilot study provides an in-depth analysis of visual parameters among 198 male drivers aged 18 to 56 years in Mathura. The predominance of male participants reflects the male-dominated nature of the commercial and public driving workforce in India, particularly in North Indian cities such as Mathura. The findings reveal a concerning prevalence of visual impairments that could pose significant safety risks on Indian roads [7].

Visual acuity, defined as the eye's ability to resolve fine detail, is fundamental to tasks such as reading road signs, recognizing pedestrians, and gauging distance and speed. In the present study, only 61% of participants had normal binocular visual acuity, whereas 29% failed the test and 10% required retesting. Right-eye performance showed a 33% failure rate, while the left eye was slightly better at 25%. These results are consistent with prior research by Chauhan et al. in Guwahati, where 15% of drivers had poor visual acuity in one eye and 4% in both eyes.

The high prevalence of visual acuity deficits, especially monocularly, suggests that a significant proportion of licensed drivers in urban India may not meet the recommended visual standards for safe driving. This raises concerns about the adequacy of current vision screening protocols used during driver licensing. Although many drivers may compensate for poor vision in one eye with better vision in the other, this can result in reduced depth perception and slower response times, increasing the likelihood of collisions [8].

The ability to see in low-light conditions and recover quickly from bright light exposure are essential for safe night driving. In this study, 12% of drivers had impaired glare recovery, and 8% had poor night vision. These findings reflect a persistent problem in the Indian driving population, especially given the common usage of high-beam headlights and poorly lit roads. Previous Indian studies also indicate similar findings; for instance, Chauhan's study reported 7% failure in glare recovery and 5% in night vision [9]. Drivers with poor glare recovery may experience temporary blindness when facing headlights, while those with reduced night vision may be unable to detect pedestrians, road barriers, or animals in time to avoid a crash. This problem is exacerbated in urban Indian settings where visual clutter, reflective surfaces, and inconsistent street lighting are common. Given that many road accidents in India occur during nighttime or low-light hours, the data supports the integration of glare recovery and night vision testing into routine driver licensing assessments [10].

Color vision is crucial for interpreting traffic signals, warning signs, and road markings. In our study, 23% of drivers failed the color vision test, while an additional 13% required retesting. That means more than one-third of drivers might struggle to differentiate red, green, or amber lights, potentially delaying reaction times or leading to incorrect decisions at intersections [11].

This high prevalence is alarming considering that current Indian licensing policies do not mandate formal color vision screening. Globally, countries such as the UK, Australia, and Canada have stricter policies regarding color vision and driving eligibility, especially for commercial vehicle drivers. India's policies should consider revising guidelines to include screening and suitable restrictions or corrective recommendations for drivers with moderate to severe color vision deficiencies [12].

Phoria, or the latent misalignment of the eyes, affects binocular coordination, depth perception, and sustained visual focus. Our findings indicate that 24% of drivers had phoria-related abnormalities, and 7% needed retesting. These figures closely align with Chauhan's findings where 3% of drivers failed the phoria test, albeit our study shows a much higher burden [13].

Such impairments may not be apparent during routine eye checks but could become significant during prolonged driving, fatigue, or while navigating complex environments requiring rapid eye coordination. Drivers with untreated phoria are at higher risk for delayed hazard perception and may experience symptoms such as eye strain or double vision under stressful driving conditions. Including a simple phoria test in routine driver screenings could help detect such hidden vision deficits early [13].

Peripheral vision is vital for detecting vehicles approaching from the side, merging onto highways, or observing pedestrians and cyclists. Our study showed that around 20% of drivers had substandard horizontal visual fields in at least one eye. This is particularly concerning as international regulations (such as those from the DVLA in the UK) require a minimum 120-degree field of vision for driving eligibility [9].

In India, where traffic violations and lane indiscipline are prevalent, reduced peripheral awareness can have grave consequences. A driver with poor horizontal vision may fail to notice vehicles in adjacent lanes or pedestrians crossing roads, leading to accidents that could otherwise have been avoided [12].

The findings of this pilot study raise critical concerns regarding the current driver screening and licensing procedures in India. The Motor Vehicles Act (1988) stipulates a basic medical certificate at the time of license application, but enforcement and standardization of vision screening remain inconsistent across regions. Our results indicate that many drivers with significant visual deficiencies are still able to obtain and retain valid licenses, posing a risk to themselves and others [5].

There is an urgent need to revise licensing protocols by incorporating standardized vision tests, including but not limited to Snellen visual acuity, color vision (Ishihara or equivalent), glare recovery, night vision, phoria assessment, and horizontal visual field testing. These assessments should not only be mandatory for first-time applicants but also for license renewals, especially for individuals aged over 40 years, when visual performance typically begins to decline [9].

Moreover, public awareness programs targeting vision care and routine eye check-ups among drivers should be actively promoted. Regular driver education workshops focusing on vision health, ergonomic habits, use of corrective eyewear, and avoidance of nighttime driving in case of deficits can play a pivotal role in enhancing road safety [14].

Limitations of the Study

As a pilot study, this research has certain limitations. The sample size, although adequate for initial exploration, is not representative of the larger driver population of Mathura or India. Only male drivers were included, potentially excluding gender-specific variations in vision performance. Also, since this was conducted at a single clinic in Mathura, regional differences in visual health and access to care may limit generalizability. Future multicentric studies with a larger and more diverse cohort are needed to confirm these findings and guide national policy-making.

Conclusion

This pilot study highlights the significant prevalence of vision impairments among drivers in Mathura, with considerable deficits noted in visual acuity, glare recovery, night vision, color perception, phoria, and peripheral visual fields. These impairments, if unaddressed, can pose serious risks to road safety, both for drivers and other road users. Despite existing regulations, current licensing protocols in India often overlook comprehensive visual assessments. The findings underscore the urgent need to revise driver licensing frameworks by incorporating standardized vision screening tests and periodic re-evaluation, particularly for aging drivers. Additionally, increased awareness, public education, and mandatory medical referrals for drivers with identified impairments are crucial steps toward reducing road traffic accidents related to poor visual performance. A stronger vision-screening program, supported by policy and public health initiatives, can significantly enhance the safety and efficiency of road transport in India.

References

1. Alvarez Peregrina C, Martinez Perez C, Villa Collar C, Sánchez Tena MÁ (2021) Influence of Vision on Drivers: A Pilot Study. International Journal of Environmental Research and Public Health 18: 12105-12116.
2. Boadi Kusi SB, Kyei S, Asare FA, Owusu Ansah A, Awuah A, et al. (2016) Visual Function Among Commercial Vehicle Drivers in the Central Region of Ghana. Journal of Optometry 9: 54-63.
3. Chauhan S (2009) Influencing Traffic Problem Parameters Through Improved Driver Education and Licensing. IIT 25.
4. Congdon N, O'Colmain B, Klaver CCW, Klein R, Muñoz B, et al. (2004) Causes and Prevalence of Visual Impairment Among Adults in the United States. Archives of Ophthalmology 122: 477-485.
5. Dandona R, Kumar GA, Dandona L (2006) Risky Behavior of Drivers of Motorized Two Wheeled Vehicles in India. Journal of Safety Research 37: 149-158.
6. (2021) Eyes. Cleveland Clinic https://my.clevelandclinic.org/health/body/21823-eyes.
7. Sanjay D (2025) Glare http://sdhawan.com/ophthalmology/glare.html.

8. Murata T, Nakagawa K, Khalil A, Ishibashi T, Inomata H, et al. (1996) The Relation between Expression of Vascular Endothelial Growth Factor and Breakdown of the Blood-Retinal Barrier in Diabetic Rat Retinas. Laboratory Investigation; A Journal of Technical Methods and Pathology 74: 819-825.
9. Sarsam S (2012) Assessing Driver Characteristics at Baghdad CBD. In Proceedings, 6th Jordanian Conference of Traffic Safety 18-20.
10. The Editors of Encyclopedia Britannica (2025) Colour Vision https://www.britannica.com/science/color-vision.
11. Wikipedia Contributors (2025) Driving licence in India. Wikipedia https://en.wikipedia.org/wiki/Driving_licence_in_India.
12. Wikipedia Contributors (2025) Night vision. Wikipedia, The Free Encyclopedia https://en.wikipedia.org/wiki/Night_vision.
13. Neelima C, Arun L, Kamini G, Ankit Bhatnagar (2013) Visual Challenges among Drivers: A Case Study in Delhi, India. International Journal of Innovative Research in Science Engineering and Technology 2: 3074-3078.
14. Jose L, Javier MM, Jaime G, Mariano A (2020) Development and Calibration of an Eye-Tracking Fixation Identification Algorithm for Immersive Virtual Reality. MDPI https://www.mdpi.com/1424-8220/20/17/4956#metrics.