

Incidence of ocular and systemic diseases affecting visual function among state bus drivers

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Purpose: To evaluate the incidence of ocular and systemic disease affecting visual function among state transport corporation bus drivers in a south Indian district. **Methods:** This retrospective study analysed the records of all the drivers who presented to a south Indian tertiary-care eye hospital in 2019 for their mandatory annual ocular check-up. Details reviewed included demographic details; refraction; presence of systemic and ocular diseases with vision-threatening potential; presence of ocular conditions responsible for visual loss and the treatment administered. **Results:** 3042 drivers (mean age, 47.0 ± 5.7 years) were evaluated. Visual function-threatening systemic diseases were present in 25.0% drivers, out of which diabetes mellitus (18.7%) was the most common pathology. The most common ocular problem was refractive error (45.0%). Visual function-threatening ocular diseases were present in 9.5% drivers. Diabetic retinopathy, visually-significant cataract, glaucoma and central serous chorioretinopathy were noted in 4.0%, 1.9%, 1.7% and 0.8% drivers. Surgical intervention was required in 2.2% drivers. Thirteen drivers were temporarily deemed unfit for driving heavy-weight vehicles. **Conclusion:** Several bus drivers suffer from vision-threatening systemic and ocular diseases. Some of them require surgical intervention to retain fitness. A complete ocular and systemic evaluation of diseases with vision-threatening potential should be performed at the time of renewal of the driving license. The drivers should be educated about the systemic diseases which can affect their driving skills and must be encouraged to seek medical help at an early stage.

Key words: Diabetes mellitus, heavy-weight vehicle driver, Motor Vehicle Act (MVA), road traffic accident (RTA), visual function.

Road traffic injuries (RTI) are one of the leading causes of death and ranked eleventh in 2017.^[1-3] The greatest burden of these deaths is in low- and middle-income countries.^[1,2] In the absence of an official trauma registry, a large number of road-traffic accidents (RTA) go unreported. As per the official records, 449002 RTAs claimed 151113 lives and injured 451361 persons in India in 2019. This is equivalent to 1230 accidents, 414 deaths and 1237 injuries per day.^[4] The working age group (18-60 years) accounts for almost 84% of these deaths. It has been estimated that RTAs lead to a social-economic loss amounting to 3-5% of gross domestic product every year.^[4,5] Fitzharris *et al.*,^[6] reported that almost 20% of two-wheeled vehicle accidents were caused due to collision with buses and other heavy-weight vehicles (HWV).

Public bus transport is one of the most commonly used transport modalities in India. A vast majority of the population rely on this mode of transportation for commuting between and within various cities and towns. It has been estimated that 85% passengers and 65% freight travel by road.^[4] The public bus sector of India operates nearly 170000 buses daily, which carry roughly 70 million people per day.^[7] With such a large number of buses plying on the roads, which lack segregation

for motorized and non-motorized traffic, HWV drivers need to be overcautious to prevent RTAs. It has been estimated that buses accounted for 4.9% RTA-related deaths in 2019 in India.^[4] Several ocular and systemic diseases among drivers have been reported to increase the risk of such mishaps.^[8-15]

Driving licenses in India are issued by the Regional Transport Offices of each state. The rules and regulations are governed by the Motor Vehicle Act (MVA) 1988 and its amendment in 2016.^[16-18] However, there are few lacunae in the laws related to driving licensing in India.^[16-20] The visual requirement is based mainly on the gross visual acuity of the driver. However, other ocular and systemic diseases which can potentially hamper driving proficiency are ignored. Evaluation of the incidence of these diseases among the current driving-license holders will provide a baseline epidemiological data for the "high-risk drivers". Such a data can help us establish better road safety laws. Studies evaluating the visual function among the HWV drivers have been conducted in other parts of the world. However, similar studies have rarely been performed in India.

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Cite this article as: Kohli P, Babu N, Mishra C, Damodaran S, Bhavani S, Kumar M, *et al.* Incidence of ocular and systemic diseases affecting visual function among state bus drivers. Indian J Ophthalmol 2021;69:2625-8.

Access this article online

Website:

www.ijo.in

DOI:

10.4103/ijo.IJO_76_21

Quick Response Code:



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Received: 10-Jan-2021

Revision: 11-May-2021

Accepted: 20-May-2021

Published: 25-Sep-2021

This study was done to evaluate the incidence of ocular and systemic diseases affecting the visual function among the state transport corporation bus drivers in a district in south India.

Methods

This retrospective, observational, hospital-based study was done at a tertiary-care eye hospital in south India. The study was approved by the hospital's institutional review board. It adhered to the tenets of the Declaration of Helsinki. Records of all the drivers presenting to the hospital in 2019 for their mandatory annual ocular check-up were retrospectively analysed. Approval from the ethics committee has been obtained. The date of the approval is 2/11/2020.

As a part of the hospital protocol, a detailed history of systemic diseases with vision-threatening potential was taken from all the drivers. A comprehensive ophthalmic examination was done for all the drivers. This included visual acuity using a Snellen's chart, refraction, intraocular pressure, colour vision, visual fields (VF) and binocular single vision (BSV) evaluation followed by ocular adnexal, slit lamp biomicroscopic and dilated fundus examinations. In case of presence of any ocular pathology, appropriate systemic and ocular investigations were performed and pertinent treatment was administered.

As per the rules of the state transport corporation, the drivers have to undergo a mandatory annual ocular check-up in order to renew their driving license. Fitness certificate is given only if the best-corrected visual acuity (BCVA) is $\geq 20/20$ in their better eye and $\geq 20/40$ in their worse eye; and defects related to colour vision, visual axes, night vision, VFs and BSV are absent.

The records were analysed for demographic details; refraction; presence of systemic and ocular diseases with vision-threatening potential; presence of ocular conditions responsible for visual loss and the treatment administered.

Results

A total of 3042 drivers with a mean age of 47.0 ± 5.7 years (Range, 29 to 61 years) were evaluated in the year 2019. Visual function-threatening systemic diseases were present in 761 (25.0%) drivers [Table 1]. The most common ocular morbidity was refractive error ($n = 1377$, 45.0%). While 460 drivers had a myopic refractive error, 917 had a hypermetropic one. The mean spherical equivalent (SE) was 0.10 ± 0.64 Dioptres (Range, -9DS to 3DS). A SE > 1 DS (myopia or hypermetropia) was present in 267 drivers (8.8%).

Visual function-threatening ocular diseases were present in 290 (9.5%) drivers [Table 1]. Only 45 drivers (1.5%) complained of visual loss, while the rest came for renewal of their driving licenses. Diabetic Retinopathy (DR) was noted in 121 (4.0%) drivers. The incidence of DR among drivers with DM was 21.3%. Visually-significant cataract was present in 59 drivers (1.9%), out of which 15 had bilateral cataract and two had traumatic rosette cataract. Seventy-seven drivers (2.5%) were pseudophakic, out of which 45 had undergone bilateral cataract surgery. Two drivers were diagnosed to have hypertension based on their ocular examination.

Sixty-six drivers (2.2%) underwent surgical intervention. The surgeries included cataract surgery ($n = 41$), pan-retinal photocoagulation (PRP, $n = 13$), intravitreal injection ($n = 5$), laser iridotomy ($n = 3$), focal laser ($n = 2$), pterygium excision ($n = 2$), vitreoretinal surgery ($n = 1$), penetrating keratoplasty ($n = 1$)

and posterior capsulotomy ($n = 1$). Finally, 13 drivers (0.4%) were deemed unfit for driving HWV and their driving licenses were temporarily cancelled.

Discussion

Extrapolating the current trends suggests that deaths caused due to RTI are likely to become the fifth leading cause of death by 2030. Intending to stabilize the present rising trend of road accidents, the United Nations (UN) announced 2011-20 as the "decade of action on road safety".^[10] Reducing the number of RTI-related deaths is among one of the UN Sustainable Development Goals.^[2] Although the efforts have reduced the RTI-related death rate across the globe, India has failed to follow such a trend.^[2] As per the World Bank, 10% of the Indian hospital capacity at all times is being used for the treatment crash victims.^[22]

The government of India has committed itself to reduce the number of road accidents and resultant deaths in the country by 50 per cent before 2025.^[23] The ministry of road transport and highway observed the first national road safety month from 18th January to 17th February 2021. The aim was to create awareness about road safety and reduce the RTAs.^[5] Both the drivers and the riders were advised to be aware of their responsibilities towards preventing accidents. The government has stressed the need to upgrade the country's road safety standards to the global levels.^[5]

Diabetes mellitus (DM) among motor vehicle drivers has been shown to be a risk factor for RTAs. This has been attributed to visual impairment due to DR, sudden hypoglycaemic episodes while driving and peripheral neuropathy.^[11] Szlyk *et al.*,^[12] assessed the driving performance of 25 patients suffering from DR using an interactive driving simulator. The increased retinal thickness due to macular oedema correlated with a higher frequency of accidents and near-accidents, while prior PRP caused increased response time and sudden brakes. Hypoglycaemia can cause cognitive impairment and psychomotor retardation, thus affecting the driving performance.^[11,13] Sudden hypoglycaemic episodes while driving have been reported by 13-66% drivers.^[14-17,19,20,24,25] Patients with type 1 DM have themselves reported to be involved in traffic mishaps due to sudden hypoglycaemia while driving.^[14] Peripheral neuropathy impairs the sensation and proprioception in lower limbs, thus affecting the ability to gauge pressure on the accelerator, brake and clutch pedals.^[11]

In our study, nearly 20% drivers were found to be diabetic. This incidence is similar to that reported by other studies (7-33%) evaluating the systemic profile of HWV drivers.^[26-39] Yook *et al.*,^[31] reported that incidence of metabolic disorders was higher in bus company employees compared to the general working population. This higher incidence was attributed to the long working hours and sedentary life style among the company employees.^[11] We found that the incidence of DR among the diabetic bus drivers in our study ($>20\%$) was higher than the incidence reported among the general diabetic population in India (9.2%).^[32] Nearly 15% of the drivers suffering from DR in our study had a vision-threatening disease. Even though their visual acuity was good at the time of presentation, they needed urgent treatment in form of retinal laser or intravitreal injections.

Similarly, drivers suffering from field loss due to glaucoma are at a higher risk for RTAs.^[15,16,33] Bhorade *et al.*,^[15] reported that more than forty percent people suffering from glaucoma experienced driving difficulties. The incidence of glaucoma

Table 1: Incidence of Visual Function-Threatening Systemic and Ocular Diseases Among State Bus Drivers

Visual function-threatening systemic diseases	Incidence
Diabetes mellitus	568 (18.7%)
Hypertension	272 (8.9%)
Ischemic heart disease	43 (1.4%)
Others	20 (0.7%)
Tuberculosis	5
Human immunodeficiency virus	4
Chronic kidney disease	4
Neurological disorder	4
Blood dyscrasia	3
Diabetic retinopathy	121 (4.0%)
Proliferative	15
Non-proliferative	106
Centre-involving diabetic macular edema	4
Macular ischemia	1
Cataract	59 (1.9%)
Glaucoma	53 (1.7%)
Primary open angle glaucoma	31
Primary angle closure	21
Traumatic glaucoma	1
Central serous chorioretinopathy	24 (0.8%)
Others	34 (1.1%)
Retinal vein occlusion	10
Pterygium	4
Retinal hole	4
Toxic Optic Neuropathy	3
Corneal ulcer	2
Vasculitis with proliferative retinopathy	2
Retino-choroidal coloboma	2
Chronic rhegmatogenous retinal detachment	1
Posterior capsular opacity	1
Corneal opacity	1
Non-arteritic Anterior Ischemic Optic Neuropathy	1
Anaemic Retinopathy	1
Hypertensive retinopathy stage IV ^[21]	1
Traumatic Optic Neuropathy	1
Total	290 (9.5%)

in our study (1.7%) was similar to that reported in the general population in India.^[34,35] The need to drive for long hours during the evening time renders the bus drivers at high risk of suffering a sudden acute angle closure attack. Hence, the drivers with shallow angles may benefit from prophylactical treatment. Since primary open-angle glaucoma is a hereditary disease, family history should be taken at the time of recruitment and these high-risk drivers should be asked to review periodically with a glaucoma specialist.^[36]

Refractive error was the most common ocular finding in our study. Without spectacles, nearly half of the drivers failed to qualify the required visual acuity criterion set by the government. A low compliance rate to spectacles has been reported in other studies.^[37] Hence, compliance to spectacles at work should be checked frequently.

Nearly 2% drivers presented with visually-significant cataract and required surgery to drive safely. It should be emphasized that drivers complaining of glare while driving in the evening may be suffering from cataract, even though their visual acuity is good. The response time of such drivers may be delayed due to the headlight glare, thus increasing the risk of collision.^[38]

CSCR causes metamorphopsia and can impair the ability to judge distances correctly. A high incidence of CSCR was noted in our study. Drivers may be at a higher risk of developing CSCR due to the high stress levels and long working hours. Although CSCR is a self-limiting disease, patients with professional demand are advised to undergo early laser treatment for faster recovery.^[39,40]

The MVA amendment in 2016 has made a number of fresh provisions in the existing laws related to the licensing process. It has called for a robust, scientific and standardised investigation of the accident. The driver(s) involved in accidents can be advised to undergo a complete ocular and systemic examination to look for risk factors which may have predisposed to the RTA. The mandatory training of drivers before attaining a driving license is another welcome step. The evaluation of driving skills through simulated tests and fatigue tests should also be considered. The renewal period of the transport drivers has been increased from three years to five years. However, frequent medical examinations should be considered.^[18]

There were a few limitations to the study. Firstly, we did not have the data related to the visual acuity, ocular morbidities and systemic profile of the drivers at the time of their recruitment. Such a data can help estimate the freshly acquired diseases among the drivers. However, we assume that they did not have any ocular or systemic diseases at the time of recruitment, except for the acceptable refractive errors. Secondly, we did not investigate for systemic diseases which can affect driving without affecting visual function. Thirdly, we did not perform blood investigations to look for their systemic control. Fourthly, ocular functions like contrast sensitivity, dark adaptation and glare testing were not evaluated. Finally, we did not evaluate the ocular and systemic profiles of the drivers who had been involved in RTAs earlier. Further studies evaluating the ocular and systemic profiles of HWV drivers from across the country are required, especially the drivers involved in RTAs.

Conclusion

To the best of our knowledge, this was the first study reporting the ocular and systemic diseases affecting visual function among HWV drivers in India. It is imperative to include complete ocular examination and systemic evaluation of diseases with vision-threatening potential at the time of renewal of driving license. The drivers need be educated about the systemic and ocular diseases which can affect their driving skills and must be encouraged to seek medical help at an early stage. The importance of regular treatment should be frequently emphasized as poor compliance has often been reported in patients with long working hours.^[41]

Financial support and sponsorship

The authors have not received any grant support or research funding.

Conflicts of interest

There are no conflicts of interest.

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