Original Article

The prevalence of refractive errors and spectacle uptake in truck drivers: A North Indian cross-sectional study

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Aims: This study analyzes the prevalence and types of refractive errors among truck drivers, as well as their uptake of glasses. **Subjects and Methods:** Retrospective cross-sectional study of data collected between July 2017 and June 2018, through eye camps held across the national capital region. An optometrist conducted a comprehensive eye examination. Refractive error was defined as myopia (spherical equivalent of at least −0.5 diopter [D]), hyperopia (spherical equivalent of at least +0.5 D), or astigmatism (only cylinder of 0.5 D or more). Drivers requiring spectacles to read at a normal distance (35–40 cm) were categorized as having presbyopia. Those needing both distance and near vision correction were analyzed separately. **Statistical Analysis:** Data were analyzed for the prevalence of refractive errors and its types. Spectacles uptake and its association with age categories, number of affected eyes, type and severity of refractive errors were analyzed. Statistical analysis was carried out using R software version 3.1.1 and Excel 2013. **Results:** Refractive error (including presbyopia) was over 26% in the 4059 truck drivers screened. 8.8% needed distance correction, 24.3% needed near correction and 6.6% needed both, at least in one eye. Uptake was only 47% among those prescribed glasses and was higher among drivers requiring only near correction. **Conclusions:** Our study highlights the importance of eye examination among truckers. There is a need to increase the uptake of spectacles by increasing awareness and developing better models of spectacle delivery.

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Truck drivers in India are estimated to be more than five million in number, with 89% trucking companies contributing three to ten million (Indian rupees, INR) annually to the 1.42 trillion (INR) road industry.[1] These truckers lead a nomadic lifestyle and have been shown to suffer from a variety of health conditions.[2] These health conditions remain undiagnosed or worsen due to the nature of their occupation, which limits, and in many cases prohibits their awareness of, and access to, proper health care.[3]

As per a 2018 report, 53% of the 1031 truck drivers surveyed during the independent Kantar study reported suffering from health problems, 8% of those citing eyesight issues.[4] These drivers also report long hours on the road without breaks,[5] resulting in body-clock reversal from late-night driving. Driving performance has been shown to be significantly associated with refractive blur and the time of day, suggesting that accurate correction of even low refractive error can help prevent adverse events, especially under night-time driving conditions.[6]

The concept of the Driver Care Program (DCP) was envisioned by our institute, in conjunction with a partner whose core work is in manufacturing auto-motives, especially trucks. DCP was launched in 2016, in the national capital region to better cater to the eye problems of truck drivers, with scale-up plans as a nationwide program. It focuses on improving the accessibility and affordability of quality eye care services for truck drivers at major transport areas by offering screening services, free or highly subsidized eye care through fixed and mobile units, and subsidized access to spectacles.

The purpose of this study was to analyze the prevalence of refractive error and its types resulting from the 1st year of this program. Spectacle uptake by this unique population was also assessed and recommendations for interventions were made.

Subjects and Methods

This is a retrospective cross-sectional study. Data were collected through routine eye camps held for drivers between July 2017 and June 2018. The study was approved by the Institutional Review Board (IRB/2019/OCT/08) and adheres to the tenets in the Declaration of Helsinki.

Prior to each camp, awareness activities were held to encourage drivers into up taking the services. These predesignated camps were conducted as per scheduled rosters and were attended by truck drivers, mechanics, and other

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helpers. As per program policy, no one can be turned away from utilizing offered services. However, for the purpose of this study, only data belonging to the drivers who were screened in the camp during the study was included.

The eye examination comprised a complete optometry workup including vision, refraction, and slit-lamp examination. An optometrist, who also performed the comprehensive eye screening, performed refraction. Spectacles were available at subsidized rates, for those who were diagnosed with refractive errors. For spectacles that needed customization, details of the drivers were noted, an initial booking amount was taken, and the spectacles were delivered at a later date to fleet owners where the camps were conducted for pick up by the drivers.

For the purpose of prescribing glasses, refractive error was defined as myopia with a spherical equivalent of at least −0.5 Diopter (D), hyperopia of +0.5D, and astigmatism as a cylinder of 0.5D or more.[7]

$$\text{Spherical equivalent} = \text{Sphericalcorrection} + \frac{\text{Cylindrical correction}}{2}$$

Drivers requiring glasses for reading at a normal distance of 35–40 cm were categorized as those with near vision problems. Drivers affected by distance vision problems were categorized as suffering from either myopia or hyperopia with or without astigmatism. Those needing both distance and near vision correction were analyzed as a separate category.

The cutoffs used for myopia and hyperopia were more than, or equal to, 0.5 D and more than, or equal to, 0.75 D for astigmatism. Myopia of <3 D was labeled as mild, from 3 D up to 6 D as moderate, and more than 6 D as high myopia.[8] Hyperopia of <2 D was labeled as mild, from 2 D up to 5 D as moderate, and more than 5 D as high.[9]

The proportion of drivers suffering from the refractive errors and their appropriate classifications was analyzed, as was the proportion of drivers who decided to uptake glasses by purchasing. Logistic regression was applied to check the association between the uptake of glasses with an optimum combination of covariates, including age categories, number of affected eyes, presence of astigmatism, and presence of hyperopia. Statistical analysis was carried out using R software version 3.1.1 and Excel 2013 (Vienna, Austria).

Results

A total of 4059 truck drivers were examined in the camps, with the help of a mobile van, during the study. Most of the drivers belonged to the age group of 20–50 years, with the maximum, (1622, 40%) in the 20–30 years of age group. The mean age of the truck drivers in our study was 34 ± 10, with the median age being 32 years and the range 17–74 years.

Of the 4059 truck drivers who were examined for distance and near vision problems, 356 (8.8%, 95% confidence interval [CI]: 7.9%–9.6%) needed distance vision correction with or without near correction, 986 (24.3%, 95% CI: 22.9%–25.6%) needed near vision correction with or without distance correction and 270 (6.7%, 95% CI: 5.9%–7.4%) needed both, at least in one eye. The proportion of truck drivers with imperfect visual acuity (distance or near or both) was estimated to be around 26.4% (1072/4059, 95% CI: 25.1%–27.8%).

The prevalence of different types of distance vision problems and all their possible combinations with near vision problems are given in Table 1. The prevalence of myopia was 2.0% (82/4059, 95% CI: 1.6%–2.5%), hyperopia was 4.5% (182/4059 95% CI: 3.9%–5.1%) and astigmatism was 4.4% (180/4059, 95% CI: 3.8%–5.1%). The risk of myopia, hyperopia, astigmatism, and presbyopia increased with age [Figure 1]. Post 40 years, 3.7% of the truck drivers had myopia (95% CI: 2.6%–4.8%); 12.9% had hyperopia (95% CI: 11.1%–14.8%); 9.8% had astigmatism (95% CI: 8.1%–11.4%); 64.8% had presbyopia (95% CI: 62.2%–67.5%); and 65.9% of the truck drivers had at least one refractive error (63.2%–68.6%). Chi-square tests confirm that the prevalence of refractive error significantly varied over different age-classes of the truck drivers ($P < 0.001$ for each type of refractive error).

All 1072 truck drivers, who had any kind of refractive errors, in at least in one eye, were prescribed glasses. Spectacles were procured only by 47.5% of them (509 of 1072). Seven percent of the glasses (35 of 509) were for the correction of distance vision only, 80% (410 of 509) for the correction of near vision, and 13% (64 of 509) were bifocals.

The procurement of glasses by the truck drivers belonging to different refractive error categories is given in Table 2. The highest uptake of glasses was by the presbyopic truck drivers who did not have any distance vision problems. Three hundred and seventy-four of these 716 (52.2%) drivers, who required only near vision correction, bought glasses. This was significantly higher than the uptake among 86 drivers who required only distance correction (34/86; 39.5%, $P = 0.026$). Uptake was minimum among those who needed both distance and near vision corrections (37.4%, 101/270). Among the

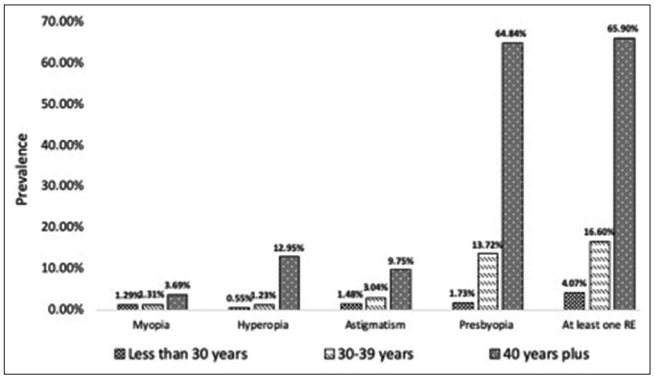

Figure 1: The prevalence of refractive errors in different age-classes of truck drivers

Table 1: The prevalence of different combinations of distance and near vision problems in truck drivers

	Number of truck drivers	Percentage	95% CI
Myopia with or without astigmatism + presbyopia	38	0.94	0.64-1.23
Hyperopia with or without astigmatism + presbyopia	176	4.34	3.71-4.96
Myopia with or without astigmatism (no presbyopia)	44	1.08	0.77-1.4
Hyperopia with or without astigmatism (no presbyopia)	6	0.15	0.03-0.27
Presbyopia with or without distance vision	986	24.3	22.97-25.61
Any refractive error at least in one eye	1072	26.4	25.05-27.77

CI: Confidence interval

Table 2: Uptake of spectacles advised in truck drivers with different combinations of distance and near vision problems

	Number of truck drivers advised spectacles	Spectacle uptake numbers				Uptake of spectacles advised (%)
		Distance	Near	Bifocal	Total	
Myopia with or without astigmatism + presbyopia	38	1	2	12	15	39.5
Hyperopia with or without astigmatism + presbyopia	176	0	26	40	66	37.5
Myopia with or without astigmatism (no presbyopia)	44	19	0	0	19	43.2
Hyperopia with or without astigmatism (no presbyopia)	6	0	0	0	0	0.00
Astigmatism only (no presbyopia)	36	15	0	0	15	41.7
Presbyopia with or without distance vision	986	1	410	64	475	48.2
Any refractive error at least in one eye	1072	35	410	64	509	47.5
Percentage	100	7	81	13	100	

past two groups (distance vision problems with and without presbyopia), the difference in uptake was not significantly significant ($P = 0.723$). Of the 101 truck drivers who accepted glasses among those needing both distance and near vision corrections, 36 received glasses for near vision correction only; 64 received bifocals and one individual received glasses only for distance vision correction. Uptake of glasses among the myopic and hyperopic truck drivers were 41.5% (34/82) and 36.3% (66/182), respectively, and difference was not significantly significant ($P = 0.4$).

Uptake of glasses varied significantly across different age-classes ($P < 0.05$, Chi-square). Only 18 (27.27%) out of the 66 drivers below 30 years of age diagnosed with refractive errors, accepted glasses. It varied between 41% and 52% in the upper age classes, with an average of 49% when all classes above 30 years are combined [Table 3]. The statistical test suggests that there is no significant variation among the uptake percentages within age-classes above 30 years old ($P = 0.269$, Chi-square).

Truck drivers who had a refractive error in one eye were more likely to accept glasses compared to those who had refractive error in both eyes. Eighty percent (98/122) of those who had refractive errors only in one eye procured glasses, whereas the uptake from the other group, who had refractive error in both eyes, was only 43% (411/950). The difference was statistically significant ($P < 0.001$, *Z*-test).

Acceptance of glasses by the truck drivers did not depend on the severity or magnitude of diopter. The uptake percentage of myopia, hyperopia, and presbyopia, combined, was 47.5% among those who needed mild correction, and 47.8% among those who needed moderate correction.

We found no association between myopia and uptake of glasses. The results of the logistic regression indicate that the uptake of spectacles was positively associated with age-classes, and negatively associated with number of affected eyes, presence of astigmatism, and presence of hyperopia. The results of the multiple logistic regression analysis conform to the findings of the univariate analysis [Table 4].

Discussion

This study finds refractive error (including presbyopia) to be just over 26% in the 4059 truck drivers screened during the study. Spectacle uptake during this period was found to be only 47% of those prescribed with glasses.

While our north Indian study found the prevalence of refractive error to be 26.4% (25.0%–27.8%), another north Indian study conducted in Jammu and Kashmir found the prevalence of refractive error in truck drivers to be 17.1%.[10] Studies from south India, one conducted in Andhra Pradesh[11] and the other at the Chennai-Bengaluru highway[12] found the prevalence of refractive error to be 28.6% and a little over 31%, respectively, in truck drivers. A central Indian study from Chhattisgarh found refractive error to be prevalent in 18.8% of the truck drivers surveyed.[13] Thus, across India, or even regions, refractive error found in populations of truck drivers is not uniform and ranges from 17% to 31%.

Further, two of the referenced studies[12,13] do not segregate refractive error into near sightedness and farsightedness, but

Table 3: Uptake of spectacles in different age-classes

	Number of drivers	Percentage of drivers	Number and percentage of truck drivers with a refractive error (%)	Number and percentages of truck drivers who had a refractive error and purchased spectacles (%)
<30 years	1622	40.00	66 (4.07)	18 (27.27)
30-39 years	1217	30.00	202 (16.60)	92 (45.54)
40-49 years	830	20.40	555 (66.87)	286 (51.53)
50-59 years	336	8.30	222 (66.07)	102 (45.95)
60 years plus	54	1.30	27 (50.00)	11 (40.74)
Total	4059	100	1072 (26.41)	509 (47.48)

*There was only one truck driver (17 year old) in the 15–20 years of age class and three in the 70–80 years of age class. Instead of showing separately, these two groups have been merged with their adjacent classes

Table 4: Results of the logistic model

Covariates	Coefficients (*B*)	Level of significance	OR (Exp B)	Base category
Age 30-39 years	0.697	0.034	2.008	Age below 30 years
Age 40-49 years	1.118	0.000	3.060	
Age 50 years and above	1.020	0.002	2.773	
Number of affected eyes	−1.770	0.000	0.170	
Presence of astigmatism	−0.480	0.008	0.619	Absence of astigmatism
Presence of hyperopia	−0.336	0.063	0.715	Absence of hyperopia
Constant	2.441	0.000		

OR: Odds ratio

our study finds prevalence of myopia, hypermetropia, and astigmatism to be 2.0%, 4.5%, and 4.4%, respectively. The other north Indian study reports figures where prevalence of myopia, hypermetropia, and astigmatism, calculated as per the formula in this study, are 6.4%, 8.6%, and 2.1%, respectively,[10] while the south Indian study from Andhra Pradesh reports the respective prevalence as, 7.9%, 14.3%, and 6.4%.[11] Thus, trends in the prevalence of types of refractive error also do not follow any pattern, both when compared region-wise (north with north) or even across regions (north with south). However, there do exist some disparities in the methodologies of these studies, which could explain some of the differences in the figures. While the studies from Andhra Pradesh[10] and Jammu and Kashmir[11] exclude presbyopia from the calculation of the prevalence of refractive error, our study and the ones from the Chennai-Bengaluru highway[12] and Chhattisgarh,[13] include presbyopia. Moreover, the sample of drivers examined in our study was much more (4059) than that in the referenced studies, most of which examined 140–150 drivers,[10-12] apart from the central Indian study which examined over a thousand truck drivers.[13]

Apart from the low acceptance of glasses among the truck drivers (47%), our study also observes that young truck drivers are less keen to use glasses. More than half of the drivers who were prescribed glasses for distance vision had power <1 D. This may have constituted a reason for the relatively low uptake of spectacles, as the drivers may not have felt any need for the corrective glasses. It is also supported by two other findings of the study. One, older truck drivers who were suffering from presbyopia were more likely to accept glasses, as near vision problems affect quality of life and are easily identifiable. Two, the rate of acceptance was 80% among those who had problems in one eye, whereas it was only 43% among those with bilateral diagnoses. This is so, as problems in one eye, can easily be detected by them, through comparisons with the better eye, on their own.

The uptake of spectacles was low in those needing distance and near correction as well as in truckers with astigmatism in distance correction. This could be attributed to nonavailability of readymade spectacles[14-16] as corrective glasses for near vision were more readily available than corrective glasses for distance vision and bifocals. However, two of the studies referenced provided spectacles to the surveyed populations free of charge,[14,16] contributing to the high uptake, while our study only provided spectacles for purchase, albeit at a subsidized rate.

To the best of our knowledge, no other study has been done in India, regarding spectacle uptake by truck drivers. Nevertheless, existing literature has a few studies discussing spectacle compliance among truck drivers in India. A descriptive interview from Odisha reports that 92.3% of the respondents replied in the negative about their usage of recommended glasses.[17]

A major limitation of this study was that not all the advised glasses for distance vision and bifocals could have been made readily available at the campsite, thus, uptake may have been affected by that. In addition, information regarding the region of India the truck drivers hail from is not available, making regional comparisons difficult for this mobile population.

Yet, a seminal strength of our study, making it unique, is its screening of one of the largest series of long-distance Indian truck drivers for refractive error and spectacle uptake. This is especially so when compared to numbers reported in earlier studies of truck drivers in India.[10-14] While existing literature has focused on the prevalence and types of refractive errors found in this unique population or even the pattern of ocular conditions,[10-14] our study has taken this analysis a step further by analyzing the spectacle uptake of this mobile population.

Conclusion

Providing health-care facilities to a mobile population of truck drivers is a trial for most health service providers.[18] On the basis of our study, we would like to recommend interventions targeted at generating awareness regarding the need of regular eye examinations and the importance of uptake of glasses. This could be included along with road safety and other health care programs meant for this population. Better models for spectacle dispensing, along with provisions for more readymade spectacles on-site to increase uptake are recommended, especially for distance vision spectacles and bifocals.

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Conflicts of interest

There are no conflicts of interest.

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