Prevalence, Socio-Demographic and Driving Related Factors Associated with Visual Impairment in Commercial Drivers Routing Benin City, Edo State, Nigeria

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Abstract

Visual impairment (VI) is a loss of vision that cannot be fully corrected by standard means like glasses or surgery. It affects the cognitive, motor, and sensory skills including driving skills and prompt decision-making to executive visual functions required for safe driving. This survey aimed to evaluate the prevalence, socio-demographic, as well as driving related characteristics associated with visual impairment among drivers of commercial vehicles in Benin Metropolis, Edo State, Nigeria. This study adopts descriptive cross-section assessment of 341 commercial drivers of mean age 48.09 ± 11.21 years (range: 20 - 70 years) using purposive sampling technique. Data for the study were obtained using National Eye Institute Vision Functioning Questionnaire–25 modified for the study. Distance Snellen Chart was used to evaluate presenting visual acuity (PVA). IBM-SPSS version 29.0 was used in analysing the data, and factors associated with VI were tested with Chi-square statistics. An overall number of 341 commercial drivers were recruited of which males were 326 (95.6%). This study showed VI prevalence of 9.7%, with mild, moderate and severe VI of 2.1%, 7.3% and 0.3% respectively. Refractive error (39.2%) and cataract (21.6%) were the major determinants of VI. Senescence, lesser educational level and number of self-reported road traffic accidents were found to be statistically correlated with VI ($P<0.05$). The high prevalence of VI reported in this research could be a threat to safe driving if appropriate measures are not put in place to identify drivers with VI. We, therefore, recommend routine comprehensive eye evaluation of drivers preceding conferment and renewal of driving licence.

Key words: Cataract, Drivers, Refractive Errors, Traffic Accidents, Visual Impairment

Introduction

Visual impairment as defined by the International Classification of Diseases (ICD-11) as presenting distance visual acuity (PVA) less than 6/12 but better or equal to 3/60 and/or a corresponding visual field (VF) of less than 20 degrees around central fixation in the better eye, with presenting optical correction, if any.[1,2] VI has been estimated to be a public health burden to over 2.2 billion humans in the world,[3] with over 80% of causes of VI being preventable.[4] Uncorrected errors of refraction, myopic macular degeneration, glaucoma, cataracts, ARMD (age-related macular degeneration), and diabetic retinopathy have been identified as the leading determinants of VI.[2,3]

Visual impairment is a major contributor to road traffic accidents (RTAs), most especially in under developed nations including Nigeria. In such low resource settings, road crashes are indicated to account for up to 85% of all casualties, and about 90% of disability-adjusted life years losses are attributed to traffic-related injuries.[5] Road traffic accidents are recorded as the chief cause of ocular morbidity and visual deficit.[6] Traffic accident injuries represent the main determinant of mortality for persons aged 5–29 years. It is the eighth predominant cause of mortality globally across every age categories, claiming more than 1.35 million deaths each year[7,8]. RTA is forecasted to emerge as the seventh foremost cause of mortality across every age categories by 2030.[9]

Road-traffic accidents in Nigeria accounts for around 10,000 deaths and 25,000 non-fatal injuries yearly.[10,11] Based on these statistics, dismissing the importance of vision would be indefensible, as vision contributes about 95% of the information required for driving tasks.[12] To drive safely, individuals need intact perceptual-motor abilities, which enable the coordination of sensory inputs with corresponding motor actions.[13] Compared to younger individuals, previous studies showed that older drivers exhibit slower response times on cognitive tasks that requires attention and visual processing, and decision-making in order to execute visual functions promptly,[13,14] considering that the occurrences of visual disorders rise with advancing age[15]. Consequently, with increasing age, a corresponding reduction in driving

proficiency occurs, which may lead to increase in accident rate.[16]

The causes of RTA are broadly divided into 3 classes: road/ environmental conditions; vehicle-related features; and human-related characteristics.[17] Human-related factors are often acknowledged as the primary influencing factor to road traffic accidents. Notably, driver behaviour is influenced by variations in road/environment, as well as reactions to harsh weather and climate such as fog, poor clarity, and inadequate light sources may increase the likelihood of collisions on road.[18]

Commercial drivers function within constantly changing and intricate environment, necessitating independent and quick decisions that require adequate vision.[19] Vision constitutes a fundamental physical requirement for effective driving and is essential for identifying road hazards, reading road signs and monitoring dashboard information such as vehicular speed.[20] Evidences suggest high occurrence of uncorrected visual deficits in commercial drivers residing in low-and middle-income countries (LMICs).[10,21–24] Scholarly finding from systematic review including meta-analysis in LMICs indicates central vision impairment is associated with 46% higher risk of road traffic accidents among drivers compared to the drivers with normal vision.[25]

In many countries, obtaining a driver's licence requires passing an eye examination, and those whose visions do not meet the minimum standard of visual acuity are denied issuance of driver's licence.[26] The drawback is that such tests overlook episodic or temporary vision disturbances, which frequently pass unnoticed but can suddenly impair driving ability.[27] This concern is especially true in conditions such as amaurosis fugax, occipital seizures, visual auras or acute heart failure syndromes, which threatens the safety of both the driver and surrounding traffic.[27]

Prevalence of visual impairment, as well as socio-demographic and driving-related factors are studied. The results obtained from this survey will help comprehend the severity and influencing factors that correlate with visual impairment in drivers of commercial motor-vehicles in the Metropolitan area of Benin, Edo State, Nigeria, and they will provide the cornerstone for the development and execution of preventive actions by relevant authorities.

Materials and Methods

Study Design

The study adopted descriptive cross-sectional design. Data were obtained through the use of National Eye Institute Visual-Functioning Questionnaires-25, modified to suit the study and self-administered to the respondents. Comprehensive ocular examinations, including assessment of visual impairment of 341 drivers of commercial vehicles in Benin City were performed.

Study Area

This study was conducted in the central area of Benin City. The geopolitical zone where Edo state is situated is known as South-South, a major producer of oil and agricultural products and is home to 3,602,124.[11] The state consists of 3 senatorial districts, which are: Edo-South, Edo-Central and Edo-North with eighteen Local Government areas. Benin City is a Government hub of Edo State, and the economic nerve of the state[28].

Population of Study

The study investigated visual impairment among commercial drivers with age ranging from 20 to 70 years, mean age of 48.09 years ± 11.21 standard deviation in Benin City, Nigeria.

Selection Criteria

Commercial motor-vehicle drivers who had been operating routes within Benin City metropolis with a minimum of one year preceding the research were included. Drivers not available within the survey timeframe, as well as those unwilling to consent were excluded.

Sample Size Determination

Fischer's formula for sample proportion was used to estimate minimum sample size for this study.[29]

$$n = \frac{Z^2pq}{e^2}, \quad \text{Where;}$$

n → desired sample size; Z → normal curve's abscissa = 1.96; e → degree of accuracy = 5%; p → estimate of population prevalence which is taken as 15%[30]; q → 1-p = (1-0.15).

Hence, $n = \frac{Z^2pqD}{e^2} = \frac{(1.96)^2 \times 0.85 \times 0.15}{0.05^2} = 196$

Considering attrition factor of 10% = 20; least sample size = 216 Respondents

Sampling Technique

A purposive sampling method was utilized in selecting a total of 341 commercial drivers from Benin City Central Motor Park.

Data Collection

Comprehensive eye examinations including presenting visual acuity evaluation, external examination, ophthalmoscopy and refraction were conducted in a conducive well-lit indoors section at the central motor park.

Socio-demographic and driving-related data including age, sex, education, driving experience years, daily driving time, and self-appraised road traffic collisions were documented with a modified version of National Eye Institute Vision Function Questionnaire[31] which was administered to each participants. Distance Snellen's chart was used to evaluate presenting visual acuity (VA) monocularly so as to document the level of vision. The distance Snellen's chart was positioned at 20 feet distance [29,32,33] in a well-lit space. Visual acuity of each eye was defined as the last correct line read by the subject on the chart.

The determination of visual impairment in this survey was dependent on visual acuity testing in the best eye. Normal/near normal visual acuity was defined as PVA of 6/12 or better in the best eye. Visual impairments were defined as visual acuity of worse than 6/18 in the better-seeing eye. Visual impairment was classified as follows.[33,34]

i. Mild VI corresponded to a PVA between < 6/12 - 6/18 in the best eye.
ii. Moderate VI) corresponded to a PVA between < 6/18 - 6/60 in the best eye
iii. Severe VI corresponded to a PVA between < 6/60 - 3/60 in the best eye.
iv. Blindness corresponded to a PVA < 3/60 in the best eye.

Trial-lens box, Keeler-retinoscope, and Snellen's-chart were used to determine the refractive errors of enrolled subjects. Penlight and Keeler-ophthalmoscope were used in evaluating the outer and inner ocular structures respectively.

Data Analysis

Data collected were entered in Microsoft Excel sheet, thereafter, analysed with IBM-SPSS program, version 29.0 using Chi-square test. Frequency distribution and descriptive data were presented in tables in

order to ascertain the prevalence of VI. Probability less than 0.05 was considered as significance level.

Ethical Consideration

Ethical permission was given by Faculty of Life Sciences Ethics Committee, University of Benin for the study, with ethical approval number FLSEC 2024/018. Permission to use Benin City Central-Motor Park was obtained from its Director. Each participating driver gave informed consent for the study.

Results

The study results revealed that over half of the participants belonged to the Edo ethnic group, while 13.8% were Deltans. Majority (95.6%) of the study population were males. Participants aged 41-50 years (45.5%) and 51-60 years (24.0%) represent the majority of the study sample. The majority of participants were educated, comprising 39.9% with secondary level of education and 37.5% with tertiary level of education. The Majority (76.2%) participants were self-employed, and over 50% had at least a decade of driving experience. The majority (73.9%) of participants reported driving for above 5 hours per day, and reported no traffic collisions in the year preceding the study. Meanwhile, 21.7% of the respondents reported experiencing 1-2 traffic collisions within the year preceding the study (Table 1).

Table 1: Social and Demographic Characteristics of Participants

Variables	Options	Frequency (N= 341)	Percentage (%)
Ethnic groups	Edos	202	59.2
	Igbos	33	9.7
	Deltans	47	13.8
	Yorubas	8	2.3
	Others	51	15.0
Sex	male	326	95.6
	female	15	4.4
Age Groups (years)	20-30	13	3.8
	31-40	41	12.0
	41-50	155	45.5
	51-60	82	24.0
	> 60	50	14.7
Educational Status	none	24	7.0
	primary	53	15.5
	secondary	136	39.9
	tertiary	128	37.5
Employment Status	self-employed	260	76.2
	company employed	81	23.8
Years of driving Experience	< 3	20	5.9
	3-5	33	9.7
	6-10	91	26.7
	> 10	197	57.8
Validity of driver's licence	valid	246	72.1
	invalid	95	27.9
Hours driven per day	< 3	29	8.5
	3-5	60	17.6
	> 5	252	73.9
Number of self-reported road traffic accidents	none	252	73.9
	1-2x	74	21.7
	3-4x	11	3.2
	> 4x	4	1.2

Figure 1 shows 308 (90.3%) of the respondents had normal vision and 33 (9.7%) of them were visually impaired.

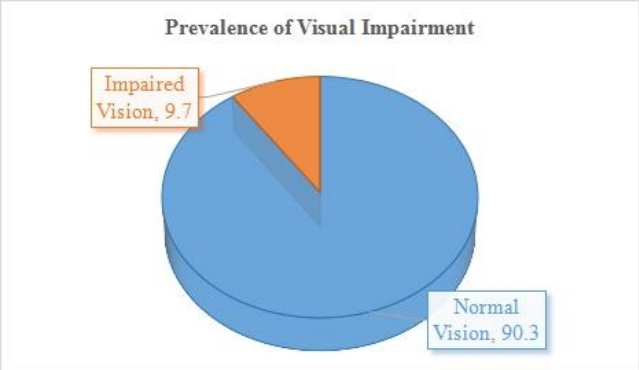

Figure 1: Prevalence of Visual Impairment in Commercial Motor-vehicle Drivers

Figure 2 showed that 90.3% of the drivers had normal vision (VA ≥ 6/12). Meanwhile, mild, moderate and severe VI were present in 7 (2.1%), 25 (7.3%) and 1 (0.3%) of the study population respectively.

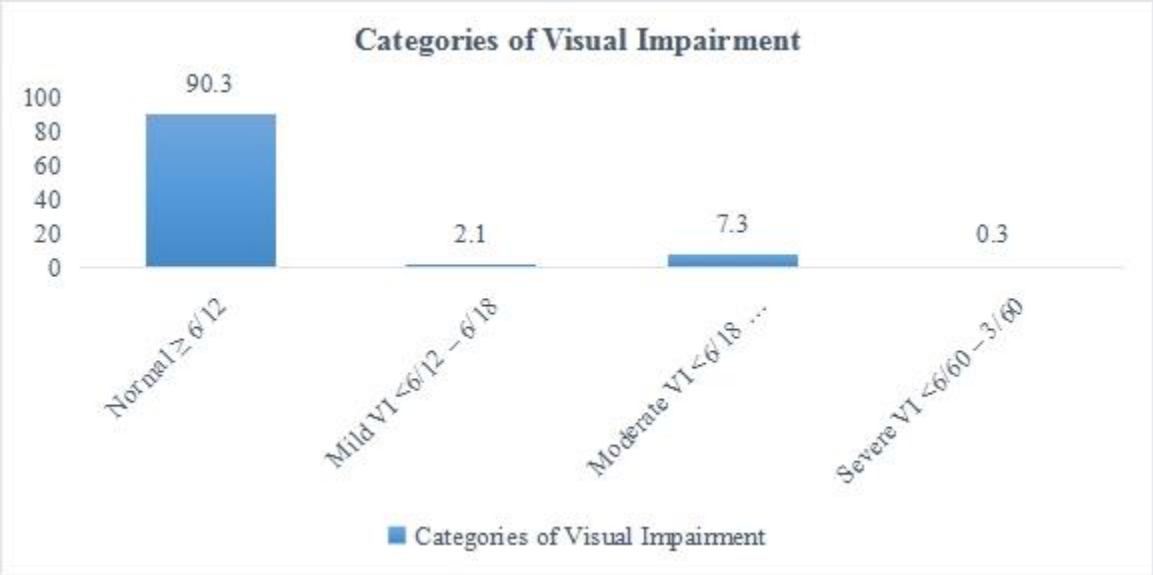

Figure 2: Visual Impairment Categories among Commercial Drivers in Benin City

Results showed that VI was chiefly attributable to error of refractive (39.2%), followed by cataract (21.6%) and glaucoma (9.3%) respectively (Figure 3).

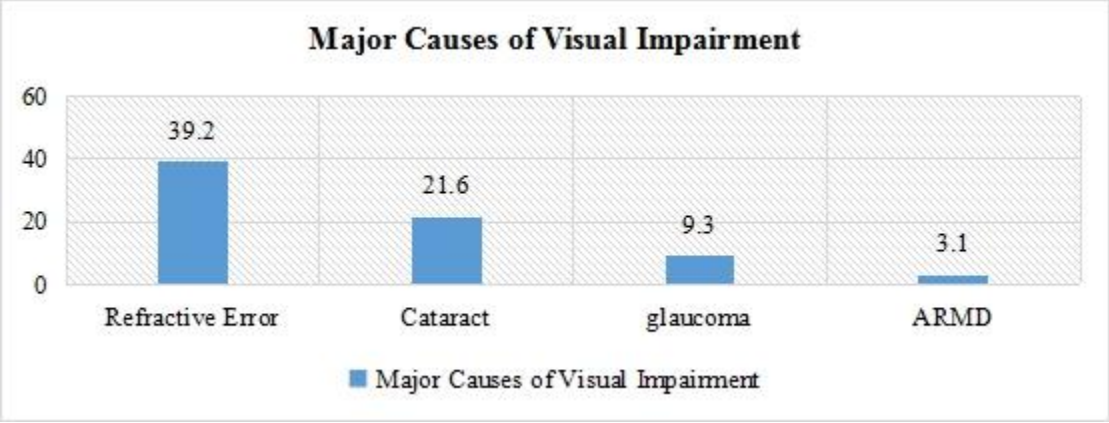

Figure 3: Main Causes of Visual Impairment among Commercial Drivers in Benin City

Table 2 show results of socio-demographic and driving related factors linked with VI. Findings shows that Edo and Delta ethnicities had 3.2% and 2.1% moderate visual impairment respectively. The link between VI and ethnic group demonstrate no statistical significance ($P > 0.05$). Although, connection between VI with gender was not significant statistically ($P > 0.05$), VI only occurred in males for which mild and moderate VI make 2.1% and 7.3% respectively. Visual impairment (moderate) increases with increase in age from 0.3% among age groups 20 – 30 years to 3.2% among participants aged over 60 years. The connection between VI and age groups demonstrated significance at the statistical level ($P < 0.05$).

Similarly, VI decreases with higher level of education from 3.2% among respondents with primary education to 1.2% among respondents with tertiary educational status. VI and level of education was significantly connected ($P < 0.05$). Furthermore, this survey demonstrated that there was no signification relationship amidst VI with employment status, driving experience years, driving licence validity, and hours driven daily ($P > 0.05$). With respect to number of self-reported traffic accidents, 4.4% of respondents that reported no accident had moderate VI, while those that reported 1 – 2 times traffic accident had 1.2% and 2.6% mild and moderate VI respectively. The link between VI and number of road traffic collision in the preceding year showed significant statistical value ($P < 0.05$).

Table 2: Visual Impairment by Socio-Demographic and Driving- related Factors

		Presenting distance VA Categories					
Variables	Options	Normal (%)	Mild VI (%)	Moderate VI (%)	Severe VI (%)	P-Value (P<0.05)	X^2
Ethnic groups	Edos	191 (56.0)	0	11 (3.2)	0	.214	20.130
	Igbos	29 (8.5)	2 (0.6)	2 (0.6)	0		
	Deltans	37 (10.9)	2 (0.6)	7 (2.1)	1 (0.3)		
	Yorubas	6 (1.8)	0	2 (0.6)	0		
	Others	45 (13.2)	3 (0.9)	3 (0.9)	0		
Gender	male	293 (85.9)	7 (2.1)	25 (7.3)	1 (0.3)	.580	1.681
	female	15 (4.4)	0	0	0		
Age Groups (years)	20-30	12 (3.5)	0	1 (0.3)	0	.002	42.511
	31-40	39 (11.3)	0	2 (0.6)	0		
	41-50	149 ()	3 (0.9)	3 (0.9)	0		
	51-60	74 (21.5)	0	8 (2.3)	0		
	> 60	34 (9.9)	4 (1.2)	11 (3.2)	1 (0.3)		
Educational Status	none	20 (5.8)	1 (0.3)	3 (0.9)	0	<.001	32.958
	primary	41 (11.9)	0	11 (3.2)	1 (0.3)		
	secondary	123 (35.7)	6 (1.8)	7 (2.1)	0		
	tertiary	124 (36.0)	0	4 (1.2)	0		
Employment Status	self-employed	235 (68.2)	4 (1.2)	20 (5.8)	1 (0.3)	.599	1.917
	company employed	73 (21.2)	3 (0.9)	5 (1.5)	0		
Years of driving Experience	< 3	20 (5.8)	0	0	0	.779	4.867
	3-5	30 (8.7)	0	3 (0.9)	0		
	6-10	84 (24.4)	2 (0.6)	5 (1.5)	0		
	> 10	174 (50.5)	5 (1.5)	17 (4.9)	1 (0.3)		
Validity of driver's license	currently valid	227 (65.8)	5 (1.5)	14 (4.9)	0	.087	6.205
	invalid	81 (23.5)	2 (0.6)	11 (3.2)	1 (0.3)		
Hours driven per day	< 3 hrs	27 (7.8)	0	2 (0.6)	0	.077	13.460
	3-5 hrs	50 (14.5)	0	9 (2.6)	1 (0.3)		
	> 5 hrs	231 (67.0)	7 (2.0)	14 (4.1)	0		
Number of self-reported road traffic accidents	none	234 (67.9)	3 (0.9)	15 (4.4)	0	.021	20.503
	1-2x	61 (17.7)	4 (1.2)	9 (2.6)	0		
	3-4x	9 (2.6)	0	1 (0.3)	1 (0.3)		
	> 4x	4 (1.2)	0	0	0		

Discussion

Visual impairment has become a significant public health and road safety challenge globally, affecting LMICs mostly. Our study demonstrated that 9.7% of drivers in Benin City metropolis had visual impairment. This result is similar to the prevalence of 9.5% found by Shrestha *et al.* .[35] among drivers in Nepal. The result of our finding is higher than the 3.2% and 5.6% found in UK[36] and US[37] respectively. Similarly, 6.3% was reported in Kenya[38], 6.4% in China [39] and 7.5% across the six geopolitical zones in Nigeria.[40] In contrast, several other studies showed higher prevalence than the result of our study such as 11.64% in Gambia,[41] 18% in Bangladesh[24] and VI ranged between 16.8% and 36.5% [42–44] in Ethiopia. Furthermore, mild, moderate and severe VI in our survey reported 2.1%, 7.3%, and 0.3% respectively. In Eritrea, the occurrence of moderate VI and severe VI were shown as 10.5% and 3%[45] respectively, higher than our findings. In Kenya, Mathenge and colleagues reported occurrence of mild, moderate and severe vision impairment to be 5.1%, 8.1% and 0.4%, respectively.[38] Variations in visual impairment from different regions of the world may perhaps be due to differences in geographical settings, research designs, healthcare systems and driving regulations.[33,46,47] of the 9.7% prevalence of VI, refraction error was the chief determinant of VI (39.2%), followed by cataract (21.6%) and glaucoma (9.3%) (Figure 3). In a similar trend from previous researches, occurrence of refractive errors in commercial vehicle drivers were 17.7%[8] and 15.7%[48] in India, 11% and 35.7% in North-West[49] and North-Central Nigeria[33] respectively, and 21.5% in Turkey.[50] The prevalence of cataracts in East Africa varied between 8.1% and 54.8%[2], with glaucoma contributing 0.9%[51] to 36.8%.[44] Furthermore, studies conducted in Vietnam and Southeast Asia revealed that impaired vision from uncorrected refractive error raised the likelihood of road crashes by 46%.[9,15,52,53]

Socio-demographic factors show consistent patterns across countries, with older age, male gender and low education/income increasing VI prevalence and RTA risks.[13,54] Study conducted in Kenya, Mathenge *et al*. observed that men showed greater percentage of VI (8.8%) compared to women (8.2%).[38] In Rwanda, women showed a marginally higher prevalence (4.8%) compared to men (4.0%).[55] Our results showed that VI increases as age

increases. Our findings correspond with those of previous studies.[40,56] For instance, according to Abdull *et al*.[57] age is a key factor in major blinding conditions, and the World Health Organization[58] similarly reports elevated risk of VI or blindness in the elderly, both globally and locally. In our study, VI significantly decreased with higher level of education. Similarly, previous researches noted that low education and socio-economic status correlate with higher VI in LMICs like Nigeria, Laos, Indonesia, and Brazil. This is linked to low awareness of or access to comprehensive eye care services.[2,33,54] According to Nam *et al* .[59], a positive literacy leads to prevention of cataract issues. Driving-related factors such as hours of driving per day and years of driving experience did not demonstrate statistical significance in our study. Researchers remarked that long hours of driving and older years of driving experience increase RTA risk due to fatigue and senility.[10,40,41,54]

Conclusion

Poor vision observed among commercial drivers in this study is a significant public health issue that could increase the likelihood of traffic accidents. Thus, implementing eye health education and awareness initiatives in motor parks is recommended to raise awareness about the significance of good vision for driving. Results demonstrated a statistically significant association between VI with age and educational attainment, but no significant relationship was found with ethnicity, gender, licence validity or daily driving hours.

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Conflict of Interest

Authors declared no conflict of interest

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References

1. International Classification of Diseases. ICD-11 for mortality and morbidity statistics. Available from https//icd.who.int/browse/2025-01/mms/en. 2022;

2. Ayobi B, Hansraj R, Rampersad N, Urimubenshi G. Prevalence and causes of vision impairment in East Africa: A narrative review. J Public Health Africa. 2025;16(1):1–7.

3. Flaxman S, Bourne R, Resnikoff S, Al. E. Global causes of blindness and distance vision impairment 1990–2020: a systematic review and meta-analysis. Lancet Glob Heal. 2020;5:1221–34.

4. Moyegbone JE, Nwose EU, Nwajei SD, Agege EA, Odoko JO, Igumbor EO. Integration of eye care into primary healthcare tier in Nigeria health system : A case for Delta State. Clin Med Rev Reports [Internet]. 2020;3(2):1–6. Available from: https://www.auctoresonline.org/article/integration-of-eye-care-into-primary-healthcare-tier-in-nigeria-health-systemA--a-case-for-delta-state

5. Gagrai J, Prasad R, Bhagat V, Kumari S, Mishra N. A Study on the Pattern of Ocular Injuries and Their Visual Outcomes Following Road Traffic Accidents. Cureus. 2025;17(5):e83985.

6. Devandan M, Daniel L, Sanjay AB. Prevalence of Ocular Injuries Following Road Traffic Accidents Among Two-Wheeler Riders / Pillions and the Factors Influencing Them Reported in a Tertiary Care Center in Chengalpattu in Tamil Nadu , India. Cureus. 2024;16(10):1–14.

7. World Health Organization. Global Status Report on Road Safety 2018. Geneva, Switz World Heal Organ [Internet]. 2018; Available from: https://www.who.int/publications/i/item/9789241565684

8. Pant S, Bergson S, Wright DM, Piyasena P, Chan VF, Congdon N, et al. Impact of Eyeglasses on Self-Rated Driving Safety of Commercial Truckers in India : Assessment Before and After Vision Screening. Ophthalmic Epidemiol [Internet]. 2025;00(00):1–9. Available from: https://doi.org/10.1080/09286586.2025.2513534

9. Le VC, To KG, Le VD, Nguyen L, MacKenzie G, Sigwadhi LN, et al. STABLE trial of spectacle provision and driving safety among myopic motorcycle users in Vietnam: study protocol for a stepped-wedge, cluster randomised trial. BMC Trials [Internet]. 2024;25(1):825. Available from: https://doi.org/10.1186/s13063-024-08644-2

10. Dairo M, Okechukwu-Nwankpa P, Nwankpa R. Survey on visual acuity among intra-city commercial vehicle drivers in Ibadan, southwestern Nigeria. J Pub Heal Afr [Internet]. 2019;10:789. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6562253/

11. Moyegbone JE, Osaiyuwu AB, Ebeigbe JA, Asonye CC, Nwose EU. Relationship between Contrast Sensitivity and Stereopsis among Commercial Motor Vehicle Drivers ' in Benin City Metropolis , Edo State, Nigeria. J Niger Optom Assoc [Internet]. 2025;27(2):6–16. Available from: https://www.ajol.info/index.php/jnoa/article/view/303395

12. Shinar D, Schieber F. Visual require_ments for safety and mobility of older drivers. Hum Factors. 1991;33:507–19.

13. Robertsen R, Lorås HW, Polman R, Simsekoglu O, Sigmundsson H. Aging and Driving: A Comparison of Driving Performance Between Older and Younger Drivers in an On-Road Driving Test. SAGE Open. 2022;12(2):1–9.

14. Young KL, Charlton J, Koppel S, Grzebieta R, Williamson A, Woolley J, et al. Original road safety research: Distraction and older drivers: An emerging problem? J Australas Coll Road Saf. 2018;29(4):18–29.

15. Wood JM, Black AA, Dingle K, Rutter C, DiStefano M, Koppel S, et al. Impact of vision disorders and vision impairment on motor vehicle crash risk and on-road driving performance: A systematic review. Acta Ophthalmol. 2022;100(2):e339–67.

16. Toepper M, Schulz P, Beblo T, Driessen M. Predicting On-Road Driving Skills , Fitness to Drive , and Prospective Accident Risk in Older Drivers and Drivers with Mild Cognitive Impairment : The Importance of Non-Cognitive Risk Factors. J Alzheimer's Dis. 2021;79:401–14.

17. Liu J, Wang C, Liu Z, Feng Z, Sze NN. Drivers ' Risk Perception and Risky Driving Behavior under Low Illumination Conditions : Modified Driver Behavior Questionnaire (DBQ) and Driver Skill Inventory (DSI). Hindawi J Adv Transp. 2021;2021:1–13.

18. De A, De A, Eboli L, Forciniti C, Mazzulla G. "How to identify the key factors that affect driver perception of accident risk. a comparison between Italian and Spanish driver behavior,." Accid Anal Prev. 2014;73:225–235.

19. Douglas M, Swartz S. Truck driver safety: an evolutionary research approach. Transp J. 2016;55(3):258–281.

20. Verma A, Chakrabarty N, Velmurugan S, et al. Assessment of driver vision functions in relation to their crash involvement in India. Curr Sci. 2016;110(6):1063–1072.

21. Oladehinde M, Adeoye A, Adegbehingbe B, Al E. Visual functions of commercial drivers in relation to road accidents in Nigeria. Indian J Occup Env Med [Internet]. 2007;11:71–5. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3168100/

22. Ovenseri-Ogomo G, Adofo M. Poor Vision, refractive errors and barriers to treatment among commercial vehicle drivers in the Cape Coast municipality. Afr Heal Sci [Internet]. 2011;11(1):97–102. Available from: https://pubmed.ncbi.nlm.nih.gov/21572864/

23. Haliza A, Muziman Syah M, Norliza M. Visual problems of new malaysian drivers. Malays Fam Physician [Internet]. 2010;5(2):95–8. Available from: https://pubmed.ncbi.nlm.nih.gov/25606195/

24. Ahmed M, Patnaik JL, Whitestone N, Hossain MA, Alauddin M, Husain L, et al. Visual Impairment and Risk of Self-Reported Road Traffic Crashes Among Bus Drivers in Bangladesh. Asia-Pacific J Ophthalmol [Internet]. 2022;11(1):72–8. Available from: http://dx.doi.org/10.1097/APO.0000000000000471

25. Piyasena P, Olvera-Herrera V, Clarke M. Vision impairment and traffic safety outcomes in low-income and middle-income countries: a systematic review and meta-analysis. Lancet Glob Heal. 2021;9(10):e1411–e1422.

26. Moyegbone JE, Okpoghono J, Osaiyuwu AB, Oronsaye EE, Fregene FA, Ogbomo IN, et al. Impairment of depth perception and risk factors among commercial motor-vehicle drivers. Transp Res Interdiscip Perspect [Internet]. 2025;31:101444. Available from: https://doi.org/10.1016/j.trip.2025.101444

27. Finsterer J. Unimpaired vision is an indispensable prerequisite for safe driving. African J Prim Heal Care Fam Med. 2024;16(1):1–2.

28. Tunkyi K, Moldley J. "Prevalence of anaemia in a regional health facility in South Africa." South African Med J. 2016;106(1):101–4.

29. Moyegbone J, Nwose E, Anowa E, Clarke A, Odoko J, Agege A. Prevalence of Visual Impairment among Primary and Secondary School Children in Delta State, Nigeria. J Niger Optom Assoc [Internet]. 2023;25(1):42–53. Available from: https://dx.doi.org/10.4314/jnoa.v25i1.7

30. Azuamah Y, Obeme-Ndukwe O, Esenwah E, Bazuaye K, Ikoro N, Agu G, et al. An Assessment of the Visual Acuity and Contrast Sensitivity of Commercial Vehicle Drivers in Rivers State , Nigeria. Int J Res [Internet]. 2014;1(9):1269–75. Available from: https://journals.pen2print.org/index.php/ijr/article/view/781/734

31. National Eye Institute. Visual Functioning Questionnaire - 25 (VFQ-25). PB/IA [Internet]. 2000;1–16. Available from: https://www.nei.nih.gov/learn-about-eye-health/outreach-resources/outreach-materials/visual-function-questionnaire-25

32. Ramke J, Anna P, Thomas N, Renee du T, Garry B. Prevalence and causes of blindness and low vision in Timor-Leste. Br J Ophthalmol. 2007;91(9):1117–1121.

33. Moyegbone JE, Nwose E, Kio F, Agege E, Omatsuli T, Odoko J, et al. Prevalence and Pattern of Visual Impairment among Adult Population in Mangu Local Government Area of Plateau State, Nigeria. Ophthalmol Res An Int J [Internet]. 2023;18(2):18–29. Available from: https://journalor.com/index.php/OR/article/view/381

34. Bourne RRA, Flaxman SR, Braithwaite T, Cicinelli M V, Das A, Jonas JB, et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. Lancet Glob Heal. 2017;5(9):e888–97.

35. Shrestha GS, Khadka J, Shrestha S. Prevalence and causes of visual impairment among professional drivers in Nepal. Nepal J Ophthalmol. 2017;9(1):45–52.

36. Wilde C, Poostchi A, Panos GD, Hillman JG, MacNab HK, Dua H, et al. Prevalence of Reduced Vision among UK Elderly Drivers: The Bridlington Eye Assessment Project (BEAP) - A Cross-Sectional Study. Hindawi J Ophthalmol. 2022;2022:1–8.

37. Huisingh C, Levitan EB, Irvin MR, Maclennan P, Wadley V, Owsley C. Visual sensory and visual-cognitive function and rate of crash and near-crash involvement among older drivers using naturalistic driving data. Investig Ophthalmol Vis Sci. 2017;58(7):2959–67.

38. Mathenge W, Bastawrous A, Foster A, Kuper H. The Nakuru posterior segment eye disease study: Methods and prevalence of blindness and visual impairment in Nakuru, Kenya. Ophthalmology. 2012;119(10):2033–2039.

39. Zhang X, Li EY, Leung CKS, Musch DC, Tang X, Zheng C, et al. Prevalence of visual impairment and outcomes of cataract surgery in Chaonan, South China. PLoS One. 2017;12(8):1–13.

40. Ekpenyong B, Echendu D, Ekanem E. Visual health status and its relationship with road traffic accidents amongst Nigerian vehicle drivers: A publication of the Nigerian Optometric Association. Afr Vis Eye Heal [Internet]. 2020;79(1):1–8. Available from: https://avehjournal.org/index.php/aveh/article/view/577

41. Tamenti GT, Rasengane TA, Mashige KP. Visual functions and their association with road traffic accidents among vehicle drivers in Gauteng. African Vis Eye Heal. 2024;83(1):1–15.

42. Assefa N, Admas A, Adimasu N. Prevalence and associated factors of visual impairment among adults at Debre Berhan town, North Shewa, Ethiopia. BMC Ophthalmol. 2020;20(1):1–8.

43. Alemayehu H, Tegegn M, Tilahun M. Prevalence and associated factors of visual impairment among adult diabetic patients visiting Adare General Hospital, Hawassa, South Ethiopia, 2022. PLoS One. 2022;17(10):e0276194.

44. Abebe H, Wagnew F, Zeleke H, Tefera B, Tesfa S, Fetene T. Magnitude of visual impairment and associated factors among patients attending ophthalmic clinics of Debre Markos referral hospital, north West Ethiopia. BMC Ophthalmol. 2021;21(1):1–10.

45. Müller A, Zerom M, Limburg H, et al. Results of a Rapid Assessment of Avoidable Blindness (RAAB) in Eritrea. Ophthalmic Epidemiol. 2011;18(3):103–108.

46. Kobal N, Hawlina M. Comparison of visual requirements and regulations for obtaining a driving license in different European countries and some open questions on their adequacy. Front Hum Neurosci [Internet]. 2022;16:1–18. Available from: https://pubmed.ncbi.nlm.nih.gov/36248691/

47. Wang W, Yan W, Müller A, Keel S, He M. Association of Socioeconomics With Prevalence of Visual Impairment and Blindness Supplemental content. JAMA Ophthalmol [Internet]. 2017;135(12):1295–302. Available from: https://jamanetwork.com/

48. Kumar M, Mahaseth A, Parveen S, Rafeeq U, Chauhan L. Refractive errors among commercial drivers. Indian J Ophthalmol [Internet]. 2022;70(6):2112–6. Available from: 10.4103/ijo.IJO_2510_21. PMID: 35647994

49. Ibrahim U, Jalo R, Tsiga-Ahmed F, et al. Visual impairment among commercial intercity vehicle drivers in Dutse, Jigawa State, Nigeria. Ann African Med Res. 2020;3(113):14–19.

50. Erdogan H, Ozdemir L, Arslan S, Cetin I, Ozec A, Cetinkaya S, et al. Prevalence of refraction errors and color blindness in heavy vehicle drivers. Int J Ophthalmol [Internet]. 2011;4(3):319–322. Available from: 10.3980/j.issn.2222-3959.2011.03.23

51. Mathenge W, Hillgrove T, Gisagara E, et al. The Rwanda National blindness survey: Trends and use of the evidence to change practice and policy. Afr Vis Eye Heal. 2021;80(1):10.

52. Hashemi H, Fotouhi A, Yekta A, Pakzad R, Ostadimoghaddam H, Khabazkhoob M. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. Vol. 30, Journal of Current Ophthalmology. 2018.

53. Paudel P, Ramson P, Naduvilath T, Wilson D, Phuong HT, Ho SM, et al. Prevalence of vision impairment and refractive error in school children in Ba Ria - Vung Tau province, Vietnam. Clin Exp Ophthalmol. 2014;42(3):217–26.

54. Ike PI, Adam VY. Socio-demographic and Driving Characteristics Associated with Visual Standards for Driving among Mass Transit Drivers in Abuja, Nigeria. J Niger Optom Assoc. 2022;24(1):42–53.

55. Mathenge W, Nkurikiye J, Limburg H, Kuper H. Rapid assessment of avoidable blindness in Western Rwanda: Blindness in a postconflict setting. PLoS Med. 2007;4(7):e217.

56. Hashemi H, Khabazkhoob M, Saatchi M, Ostadimoghaddam H, Yektae A. Visual Impairment and Blindness in a Population-Based Study of Mashhad, Iran. J Curr Opthalmology. 2018;30(2):161–8.

57. Abdull MM, Sivasubramaniam S, Murthy GVS, Gilbert C, Abubakar T, Ezelum C, et al. Causes of blindness and visual impairment in Nigeria: The Nigeria national blindness and visual impairment survey. Investig Ophthalmol Vis Sci. 2009;50(9):4114–20.

58. World Health Organization. World Report on Disability. World Heal Organ 20 Ave Appia, 1211 Geneva 27,Switz ttps//apps.who.int/iris/bitstream/handle/10665/70670/WHO_NMH_VIP_1101_e ng.pdf?sequence=1. 2011;

59. Nam GE, Han K, Ha SG, Han BD, Kim H, Kim YH, et al. Relationship between socioeconomic and lifestyle factors and cataracts in Koreans: the Korea National Health and Nutrition Examination Survey 2008-2011. Eye. 2015;29(7):913–20.