Visual health status and its relationship with road traffic accidents amongst Nigerian vehicle drivers: A publication of the Nigerian Optometric Association

Article · December 2020

DOI: 10.4102/aveh.v79i1.577

CITATIONS
0

READS
47

3 authors:

Bernadine Ekpenyong
University of Calabar
52 PUBLICATIONS **54** CITATIONS
SEE PROFILE

Damian Echendu
State House Medical Centre, Aso Rock Abuja
4 PUBLICATIONS **17** CITATIONS
SEE PROFILE

Ekanem Ekanem
College of Medicine University of Lagos
64 PUBLICATIONS **1,123** CITATIONS
SEE PROFILE

African Vision and Eye Health
ISSN: (Online) 2410-1516, (Print) 2413-3183

Visual health status and its relationship with road traffic accidents amongst Nigerian vehicle drivers: A publication of the Nigerian Optometric Association

Authors:
Bernadine N. Ekpenyong[1]
Damian Echendu[2]
Ekanem Ekanem[3,4]

Affiliations:
[1]Department of Public Health, College of Medical Sciences, University of Calabar, Calabar, Nigeria

[2]State House Medical Centre, Aso Rock Abuja, Nigeria

[3]Department of Community Health and Primary Care, College of Medicine, University of Lagos, Lagos, Nigeria

[4]The Nigerian Optometric Association, Abuja, Nigeria

Corresponding author:
Bernadine Ekpenyong,
benyita2001@yahoo.com

Dates:
Received: 15 May 2020
Accepted: 11 Sept. 2020
Published: 07 Dec. 2020

How to cite this article:
Ekpenyong BN, 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 Vision Eye Health. 2020;79(1), a577. https://doi.org/10.4102/aveh.v79i1.577

Background: A driver's vision is an important human factor necessary for safe driving.

Aim: The aim of this study was to determine the functional vision status of drivers in Nigeria and to establish its relationship with road traffic accidents (RTAs).

Setting: Designated road lay-bys and motor parks in Nigeria.

Methods: A cross-sectional study design was used for this study, with a sample size of 3521 vehicle drivers. Twenty-seven states and the Federal Capital Territory Abuja participated in the study. Participating drivers were interviewed, and clinical eye examinations were conducted by a team of optometrists at designated Federal Road Safety Commission road checkpoints and motor parks in the country.

Results: The mean age of the drivers was 46.3 ± 10.9 years. Of the 3500 participants, 3080 (88%) were men and 2780 (79.4%) had a driving licence. The percentage of drivers who underwent an eye test before being issued a licence was generally low (median, 43.5%). A history of RTA was reported by 8.3% of the drivers. The prevalence of visual impairment was observed amongst 7.5% of drivers (95% confidence interval [CI], 6.6% – 8.5%), whilst the prevalence amongst private drivers was 6.1% (95% CI, 4.6% – 7.9%). Drivers with visual impairment were nearly two times (adjusted odds ratio, 1.7; 95% CI, 1.06–2.77) more likely to be involved in RTA compared to those without impairment.

Conclusion: This survey has demonstrated the relationship between poor vision and the occurrence of RTA. All stakeholders must work together to ensure the safety of lives and property on our roads.

Keywords: road traffic accident; vehicle drivers; visual health status; visual impairment; prevalence; driving license.

Introduction

The sense of sight is particularly important for discerning obstacles and navigating whilst driving, which is why having good eyesight is a requisite for safe driving. Road traffic accidents (RTAs) are a major, but neglected, public health challenge that requires concerted efforts for effective and sustainable prevention. Worldwide, an estimated 1.2 million people are killed in road crashes each year and as many as 50 million are injured. Projections indicate that these figures will increase by about 65% over the next 20 years unless there is a new commitment to prevention.[1] The Federal Road Safety Commission (FRSC) uses the term road traffic crash, the reason being that most traffic crashes are not accidents because they could have been prevented.[1,2] Road traffic accidents are common in Nigeria, and the reported risk factors include mechanical fault, bad road, wet road and human factors.[3]

To understand the extent of effect one's eyesight has on driving performance, researchers carry out studies to identify the magnitude of this link,[4] and a team of researchers in Tokyo studied 43 normal subjects and 100 patients with advanced glaucoma in car simulations to examine the role of specific visual subfields in accidents with oncoming cars. Results showed that advanced glaucoma patients had a considerably greater number of collisions than normal patients. With a narrowed visual field, drivers have less visual access to the motorways, which makes them more prone to collisions. According to a study[5] conducted with 270 commercial motor drivers in Osun state, 3.3% of the drivers were visually impaired[5]; a more current study in Osun state found visual impairment in 6.1% of 99 drivers.[6] The common reported causes of decreased visual acuity (VA) amongst

commercial drivers in Nigeria were refractive error and cataract; other causes included glaucoma, corneal scar and posterior segment lesions.[5,6] A study also highlighted that nearly 80% of the participants had not had any form of eye test performed prior to the study.[7] This is particularly representative of the lacking practice of performing eye examinations before obtaining a driver's licence. A study in northern Nigeria showed a higher prevalence of visual function impairment amongst drivers when compared to studies in southern Nigeria.[8] Results obtained for the prevalence of visual impairment in the northern Nigeria study were for VA, visual field and colour vision at 9.1%, 19.5% and 9.5%, respectively, therefore elucidating the impression that eye health awareness is considerably less in the north than in other parts of Nigeria or that there is less access to eye care.

A visual function study in Ghana[9] showed that there was a significant association between protanopia and the occurrence of road transport accidents (RTAs). Results also indicated that there was no significant link between visual impairment and the occurrence of RTAs.[10,11] A study in Osun state, Nigeria,[12] indicated that there was a visual impairment (VA < 6/18) prevalence of 3.3% ± 2.4 and that there was a significant link between uncorrected VA impairment in the better eye and road accidents. Studies show that poor driver vision may have a significant financial impact on an economy. A report by Republic of South Africa insurance group has discovered that road accidents caused by poor driver visions cost the United Kingdom approximately £33 million and result in about 2900 casualties annually.[13] These accidents also put a strain on the healthcare system when hospitals treat car crash victims. Vision-related accidents can be prevented by ensuring motorists take an eye examination at least every 2 years.

It is evident from the studies highlighted that certain visual impairments adversely affect driving abilities. However, the results of some studies conflict because visual impairments and effects on driving in one study may have no effect in another. It is also important to highlight that the majority of these studies were carried out on men and thus is not totally representative of a population; most also did not consider private vehicle drivers. As vision is a vital source of information during driving, having good eyesight is important and adequate measures have to be set up to ensure the safety of motorists and pedestrians. It is therefore necessary that a study of this nature is carried out to fully understand the magnitude of visual impairment amongst commercial and private vehicle drivers. To assess the visual status of drivers and determine if there is a significant association between poor eyesight and driving performance, the Nigerian Optometric Association in collaboration with the FRSC embarked on the drivers' vision project in Nigeria.

Methodology

Study area

The study was carried out in Nigeria across the six geopolitical zones in 27 selected states and the Federal Capital Territory (FCT) Abuja (Figure 1). A cross-sectional study design was used for this study, using quantitative methods of data collection.

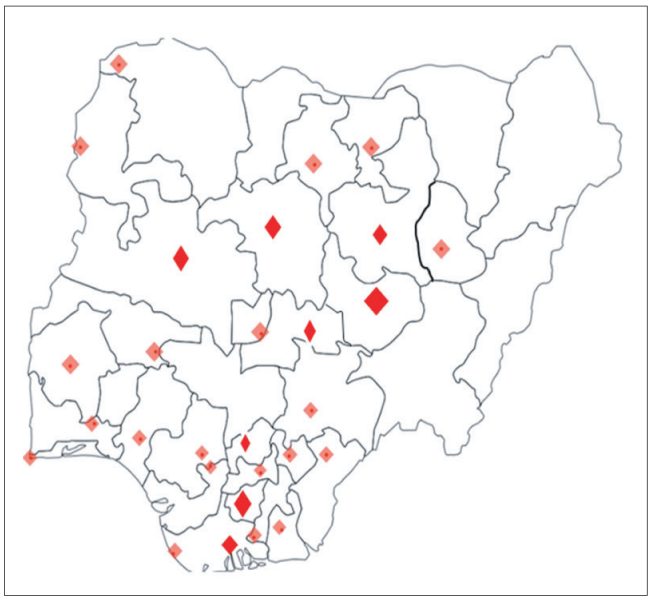


FIGURE 1: States that participated in the study.

Sample size determination and sampling procedure

The sample size of 3521 drivers used for this study was calculated based on 95% confidence interval (CI), considering a relative precision of 10%, non-response rate of 20% and prevalence of visual impairment of 12%.[11,14]

Using the formula[15,16]:

$$n = \frac{Z^2(1-P)}{\varepsilon^2 P} \quad \text{[Eqn 1]}$$

$$n = \frac{1.96^2(1-0.12)}{0.1^2 \times 0.12} \quad \text{[Eqn 2]}$$

$$n = 2817$$

Considering a non-response rate of 20%, the final sample size used was 3521 commercial and private car drivers in Nigeria. Of the 3521 drivers recruited for the study, only 3508 (99.6%) were examined. Eight questionnaires that did not meet the inclusion criteria were disregarded during data analysis, resulting in 3500 drivers' questionnaires that was analysed. Some of the drivers were impatient to wait for their turn. The numbers of questionnaires distributed to the states were based on the populations of the states and the number of optometrists practising in the states who indicated a willingness to participate.

The states were Abia, Anambra, Ebonyi, Enugu and Imo in the south-east geopolitical zone; Akwa Ibom, Bayelsa, Cross River, Delta, Edo and River in the south-south geopolitical zone; Lagos, Ogun, Oyo, Ekiti and Ondo in the south-west; Kano, Kaduna, Jigawa, Sokoto, Zamfara and Kebbi in the

north-west; and, Bauchi and Gombe in the north-east. The north-central states were Nasarrawa, Kwara and Niger and the FCT Abuja (Figure 1). The states cut across the six geopolitical zones in the country. Nine states were excluded because of the following reasons: no practising optometrists in the state, practising optometrists in the state not willing to participate or because of the insecurity of some states in the Federation at the time of this study.

Two strategies were adopted in the selection of the drivers who participated in the study across the 27 states and the FCT Abuja.

With the help of the FRSC, drivers were stopped at a lay-by, where the eye examinations and interviews were conducted. The selection was in no particular order. To encourage participation, the FRSC promised not to request for particulars, which is their usual practice. The second strategy of recruiting the drivers was to approach those who were waiting for their turn to load passengers for the day at selected motor parks. The examinations were carried out during the day between 09:00 and 15:00 in all the 27 selected states and the FCT Abuja.

Data collection procedure

The instrument for data collection was a semi-structured questionnaire made up of four sections. Section A consists of the demographic characteristics of the drivers, including years of driving experience and possession of a driver's licence.

Section B consists of the knowledge and eye-care-seeking practices amongst drivers, including history of last eye examination, history of RTA and place where eye examination was done previously. Data were collected by optometrists who were specifically trained for the purpose of the survey.

Section C consists of a clinical examination carried out by trained optometrists. The following eye examinations were carried out on the respondents: visual acuity test at distant and near using Snellen chart, which was performed in the open; VA of the right and left eyes; colour vision test using Ishihara pseudo-isochromatic colour plates; contrast sensitivity test using Lea contrast sensitivity test chart; confrontational visual fields test; ophthalmoscopy using a direct ophthalmoscope, and external eye examination using a penlight. Refraction was carried out to determine near reading power add. Free reading glasses were given to participants who met the required VA standards for driving in Nigeria, whilst those with visual impairment were referred for further examination and management.

Data management

The IBM SPSS (version 20) statistical software was used for data entry, cleaning and statistical analysis. Frequency distribution tables were generated for categorical variables such as sex, level of education and vehicle type. Visual acuity at distance of the eye with a better VA for drivers at different ages and in different zones and states were compared.

For the comparison of proportions and for testing association in contingency tables, the chi-square statistics was the test of choice. Contingency tables exhibiting low expected values (< 5) were reconstructed into four cells and evaluated using Fisher's exact test. Unconditional logistic regression technique was used to evaluate the determinants of RTA whilst controlling for possible confounders. All tests of significance adopted a two-tailed approach.

The study adhered to the ethical principles of the 1967 Helsinki declaration, as modified in Fortaleza 2013, for medical research involving human subjects.[17] Ethical approval was obtained from the Nigerian Optometric Association editorial and ethical board. The study was conducted in collaboration with the FRSC of Nigeria and the Federal and States Ministries of Health, Nigeria. Verbal informed consent was obtained from all participants prior to commencement of the study and after the study protocol was explained to them. The instrument for data collection was anonymised, and participants were free to withdraw from the study at any time if they wished to do so.

Ethical consideration

Approval to conduct the study was obtained from the Nigerian Optometric Association Health Research Ethics Committee, NOA/HREC/003/VOL.VI/101, October 2, 2017.

Results

The survey involved a total of 3508 respondents from 28 out of 37 states of Nigeria. Eight records were excluded from the analysis (three were under the age of 18, two were over the age of 80 and were not drivers and the remaining three had no vital information on their identity). The mean age of the respondents was 46.3 ± 10.9 years with a median of 46.0 years. The age and sex distribution of the respondents by zone is shown in Table 1. The age of the drivers ranged from 18 to 80 years. The majority of the respondents were between the ages of 40 and 49 years. Respondents over 60 years constituted 12.3% (431) of the participants. About nine out of 10 respondents were male drivers. There were no female drivers from the north-eastern zone of the country.

Literacy is an important attribute of a driver. A literate driver is able to read and interpret road signs and safety manuals, to appreciate the importance of road safety regulations and more likely to comply accordingly. Of the 3500 respondents, about 41% had attained up to secondary level of education. About one in four (26%) of the respondents have had a university education.

Educational status varied significantly by zone ($p < 0.01$). In the south-south zone, over one-third (35.8%) of the drivers either were university graduates or had attended a university, whereas

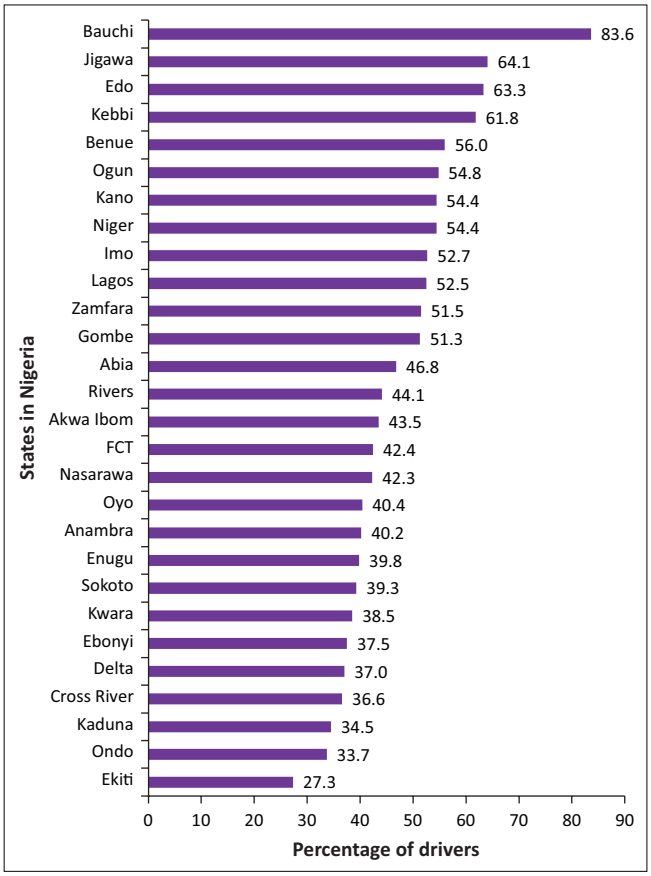
TABLE 1: Driver's characteristics.

Socio-demographic characteristics	North-east		North-west		North-central		South-east		South-west		South-south		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Age category														
< 20 years	1	0.7	2	0.5	0	0.0	2	0.2	1	0.1	1	0.2	7	0.2
20–29 years	15	10.1	16	4.0	68	9.2	43	4.6	17	2.4	45	7.9	204	5.8
30–39 years	31	20.8	52	13.0	202	27.2	176	19.0	98	13.8	126	22.0	685	19.6
40–49 years	50	33.6	149	37.3	246	33.2	316	34.1	272	38.3	215	37.6	1248	35.7
50–59 years	40	26.8	124	31.0	163	22.0	245	26.4	206	29.0	115	20.1	893	25.5
60–69 years	11	7.4	40	10.0	48	6.5	124	13.4	90	12.7	56	9.8	369	10.5
70+ years	1	0.7	12	3.0	6	0.8	17	1.8	21	3.0	5	0.9	62	1.8
Not indicated	0	0.0	5	1.3	9	1.2	4	0.4	5	0.7	9	1.6	32	0.9
Total	149	100.0	400	100.0	142	100.0	927	100.0	710	100.0	572	100.0	3500	100.0
Sex														
Male	147	98.7	362	90.5	672	90.6	830	89.5	602	84.8	467	81.6	3080	88.0
Female	0	0	23	5.8	60	8.1	81	8.7	97	13.7	98	17.1	359	10.3
Not indicated	2	1.3	15	3.8	10	1.3	16	1.7	11	1.5	7	1.2	61	1.7
Total	149	100.0	400	100.0	742	100.0	927	100.0	710	100.0	572	100.0	3500	100.0
Highest level of education														
No formal education	34	22.8	77	19.3	49	6.6	17	1.8	20	2.8	7	1.2	204	5.8
Primary	43	28.9	101	25.3	165	22.2	290	31.3	182	25.6	105	18.4	886	25.3
Secondary	56	37.6	121	30.3	274	36.9	384	41.4	344	48.5	252	44.1	1431	409
Tertiary	13	8.7	91	22.8	238	32.1	213	23.0	150	21.1	205	35.8	910	26.0
Not indicated	3	2.0	10	2.5	16	2.2	23	2.5	14	2.0	3	0.5	69	2.0
Total	149	100.0	400	100.0	742	100.0	927	100.0	710	100.0	572	100.0	3500	100.0
Vehicle type														
Commercial	121	81.2	216	54.0	385	51.9	564	60.8	455	64.1	238	41.6	1979	56.5
Private	10	6.7	126	54.0	244	32.9	259	27.9	159	22.4	267	46.7	1067	30.5
Not indicated	18	12.1	56	14.0	113	15.2	104	11.2	96	13.5	67	11.7	454	13.0
Total	149	100.0	400	100.0	742	100.0	927	100.0	710	100.0	572	100.0	3500	100.0

in the north-east zone less than 10% had attained that level. In the southern part of the country, only 1% – 2% were without formal education, whereas in the north, about 20% never had any formal education. The majority of the drivers (56.5%) in the survey operated commercial vehicles, and this was consistent throughout the zones, except in the south-south region, where most of the drivers operated privately owned vehicles.

Drivers with a licence were asked if their eyes were tested before being issued the document. Of the 2770 drivers with licence, only 1241 (44.8%) reported in the affirmative. There were significant differences between states in the proportion of drivers who went for an eye test. In Bauchi, over 80% of the drivers went for an eye test, whereas in Ekiti, less than a third (27.3%) of the drivers did so (Figure 2). Of the 2989 drivers with VA assessed at distance, 225 (7.5%) were visually impaired (presenting VA < 6/12 in the better eye), whilst 118 (3.9%) had vision less than 6/18 in the better eye (Table 2). The prevalence of visual impairment (presenting VA < 6/12 in the better eye) was higher amongst male drivers (7.7%) than their female counterparts (6.5%), but the difference was not statistically significant (p = 0.471). The number of drivers with VA < 6/18 in the better eye was 118 (3.9%), whilst that of drivers with VA < 6/60 in the better eye was 4 (0.1%). The number of drivers with monocular blindness was 25 (0.8%), with north-west zone having the highest prevalence (Table 2).

The prevalence of visual impairment by age is shown in Figure 3. The prevalence followed a J-shaped distribution with



FCT, Federal Capital Territory.

FIGURE 2: Percentage of drivers with a licence who had undergone an eye test before issuance of the document.

TABLE 2: Visual status of drivers by zone (presenting visual acuity in better eye).

Visual status	North-east		North-west		North-central		South-east		South-west		South-south		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Good on the better eye	104	91.2	207	91.1	564	94.5	717	90.4	600	91.6	472	95.7	2764	92.5
Mildly impaired	7	6.1	11	3.3	19	3.2	44	5.5	16	2.4	10	2	107	3.6
Moderately impaired	2	1.8	17	5	14	2.3	32	4	38	5.8	11	2.2	114	3.8
Blind on the better eye	1	0.9	2	0.6	0	0	0	0	1	0.2	0	0	4	0.1
Total	**114**	-	**337**	-	**597**	-	**793**	-	**655**	-	**493**	-	**2989**	-

Note: Presenting visual acuity in the better eye: normal/good or no impairment ≥ 6/12 (0.3 LogMar); mild visual impairment < 6/12–6/18; moderate visual impairment < 6/18–6/60; blind/severe blind < 6/60 to no light perception.

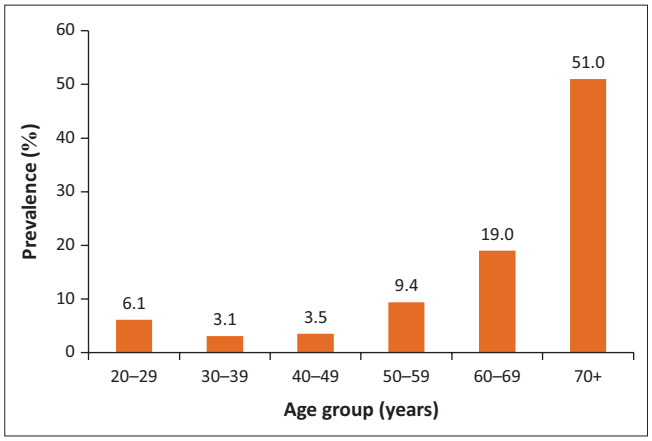
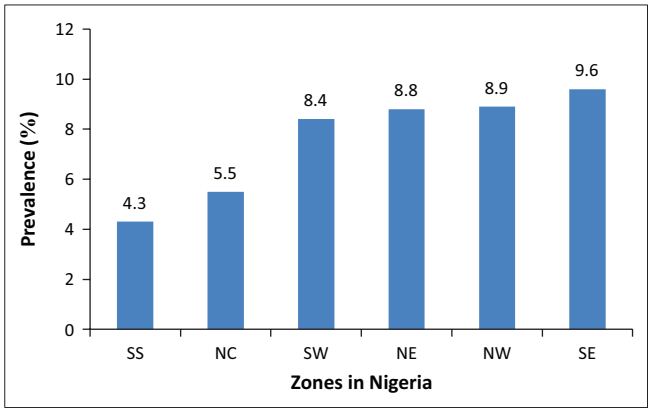


FIGURE 3: Prevalence of visual impairment by age group.



SS, south-south; NC, north-central; SW, south-west; NE, north-east; NW, north-west; SE, south-east.

FIGURE 4: Prevalence of visual impairment by zone.

prevalence higher in the 20–29 years age group than in the subsequent age group but increasing thereafter with increasing age. Visual impairment was most commonly observed amongst drivers from the south-eastern zone (9.6%), followed by those in the north-west and north-east zones and least amongst those in the south-south zone (4.3%) (Figure 4).

A total of 3137 drivers responded to the question on history of RTAs and 259 (8.3%) gave a positive history (Table 3). History of RTA did not vary significantly with zone ($p = 0.846$). Road traffic accident was common amongst male drivers (8.4%) than their female counterparts (7.1%), but the difference was not statistically significant (Table 4). At the bivariate level of analysis, level of education, possession of a driving licence, sex or years of driving experience were not significantly associated with the history of RTA (Tables 3 and 4). Age of the driver showed a marginal significant association with RTA ($p = 0.058$) (Table 3).

The multiple logistic regression analysis showed that, considering several confounders, visual impairment and age were significant predictors of RTA. Drivers with visual impairment were nearly two times (adjusted odds ratio [AOR], 1.7; 95% CI, 1.06–2.77) more likely to be involved in RTA compared with those without impairment (Table 5).

Discussion

This study covered 27 of the 36 states in the country. To our knowledge, this is the first study in the country on drivers' visual status with such a wide national coverage. In Nigeria and most other countries, RTAs are a daily occurrence, resulting in increase in morbidity and mortality rates, as well as financial cost to the parties involved and the society at large. Driving generally requires sensory (visual), mental, motor and compensatory abilities.[12] The ability to see is a paramount component of safe driving because driving relies on vision for its successful execution.[8]

We observed a prevalence of visual impairment of 7.5% (VA of < 6/12 in the better eye) amongst the drivers. However, using the FRSC minimum standards for a driving licence in Nigeria (presenting VA of < 6/9 in the better eye and worse than 6/24 in the other eye), the prevalence of visual impairment amongst commercial drivers was 14.9%. Our findings agree with a study in Ilorin, where the percentage of drivers with visual impairment was 11.5% according to FRSC standard.[14] A study in north-central Nigeria found that 90.9% of the respondents had adequate VA based on the FRSC standards for commercial driving in Nigeria. This put the prevalence of visual impairment for the study population at 9.1%.[8] Various studies have however reported lower prevalence of VA < 6/18 amongst drivers than the 3.9% recorded in this study. In a study on the effects of stimulants on visual functions and occurrence of RTAs, Oladehinde et al.[12] observed 3.3% prevalence of visual impairment (VA < 6/18). In Port-Harcourt, Pepple and Adio found the prevalence of visual impairment (VA < 6/18) to be as low as 1.8%,[10] and a study in Jos observed 3.1% prevalence of visual impairment.[18] A study in Ghana found prevalence of visual impairment to be 6.8%.[11]

Significantly higher prevalence has been reported in many other studies. The prevalence of visual impairment amongst

TABLE 3: Reported prevalence of road traffic accidents by zones and age group.

Variables	Drivers with no history of RTA		Drivers with history of RTA		Total		$\chi 2$	p
	n	%	*n*	%	*n*	%		
Zone							2.021	0.846
North-east	133	91.7	12	8.3	145	100.0		
North-west	316	91.3	30	8.7	346	100.0	-	-
North-central	613	90.5	64	9.5	677	100.0	-	-
South-east	752	92.4	62	7.6	814	100.0	-	-
South-west	577	92.2	49	7.8	626	100.0	-	-
South-south	487	92.1	42	7.9	529	100.0	-	-
Total	2878	91.7	259	8.3	3137	100.0	-	-
Age group							12.204	0.058
< 20 years	7	100.0	0	0.0	7	100.0	-	-
20–29 years	158	86.3	25	13.7	183	100.0	-	-
35–39 years	579	92.3	48	7.7	627	100.0	-	-
40–49 years	1026	91.0	102	9.0	1128	100.0	-	-
50–59 years	744	93.0	56	7.0	800	100.0	-	-
60–69 years	298	92.5	24	7.5	322	100.0	-	-
70+ years	50	96.2	2	3.8	52	100.0	-	-
Total	2862	91.8	257	8.2	3119	100.0	-	-
Highest level of education							1.720	0.632
No formal education	13	7.4	182	92.6	175	100.0	-	-
Primary	61	7.6	743	92.4	804	100.0	-	-
Secondary	115	9.0	1165	91.0	1280	100.0	-	-
Tertiary	65	7.8	764	92.2	829	100.0	-	-
Total	254	8.2	2834	91.8	3088	100.0	-	-

RTA, road traffic accident.

TABLE 4: Association between selected driver characteristics and history of road traffic accident.

Driver characteristics	Drivers with RTA		OR	95% CI	$\chi 2$	p
	n	%				
Driving licence						
Without driving licence, *n* = 469	49	10.4	1.38	0.99–1.92	3.72	0.054
With driving licence, *n* = 2579	201	7.8				
Visual impairment						
No impairment, *n* = 2525	205	8.1	1.44	0.90–2.29	2.37	0.124
Impaired, *n* = 195	22	11.3				
Sex						
Male, *n* = 2821	236	8.4	1.20	0.74–1.95	0.55	0.458
Female, *n* = 269	19	7.1				
Vehicle type						
Commercial, *n* = 1820	158	8.7	1.09	0.82–1.45	0.53	0.570
Private, *n* = 988	79	8.0				
Contrast sensitivity						
Abnormal, *n* = 131	15	11.5	1.45	0.79–2.62	1.69	0.193
Normal, *n* = 1809	148	8.2				
Colour						
Abnormal, *n* = 97	15	15.5	2.14	1.2–3.84	7.11	0.008
Normal, *n* = 2123	167	7.9				
Ophthalmoscopy						
Abnormal, *n* = 259	28	10.8	1.4	0.89–2.19	2.38	0.123
Normal, *n* = 1744	139	8.0				
Confrontation						
Abnormal, *n* = 122	14	11.5	1.44	0.80–2.57	1.49	0.222
Normal, *n* = 1750	145	8.3				

RTA, road traffic accident; OR, odds ratio; CI, confidence interval.

heavy truck drivers was 64% in a study performed in Nagpur, India.[19] A study in Owerri reported that 80% of the commercial vehicle drivers had abnormal VA[20] protocol. A similar study in Ilorin reported 11.5% prevalence of visual impairment amongst commercial drivers.[14]

It is apparent from these results that visual impairment varies from place to place and from person to person probably because of environmental exposures and host characteristics. However, some of the reported disparities may be accounted for by differences in criteria and definition of impairment. For purposes of comparability, the FRSC standard could be the gold standard for our inter-state comparison in Nigeria and the WHO standard could be used for the general population for international comparisons.

A driver's licence is an official document permitting a specific individual to operate one or more types of motorised vehicles, such as a motorcycle, car, truck or bus on a public road. In Nigeria, it is a contravention of the Federal Road Safety Act for a driver to be on a road without the driver being in possession of a valid driving licence or any other licence or permit required by law. It was observed from this study that although more than 75% had a driving licence, nearly half of the drivers in Niger and Lagos states did not possess the document. Of the several reasons that may be put forth for explaining this anomaly is the tedious process of acquiring the document in various states, particularly Lagos. A study by Cleen Foundation[21] in five states of the country documented several challenges facing driving licence applicants, which included the long and slow processing time, extortion by touts, issuance of fake licences by touts or agents and touting for driving licence applicants by FRSC official's contrary to their code of ethics.

TABLE 5: Logistic regression analysis showing relationship between some independent characteristics and occurrence of road traffic accident.

Term	Odds ratio	95% CI	Coefficient	SE	*Z*-statistic	*p*
Age	0.9809	0.9675–0.9945	-0.0193	0.007	-2.7441	0.0061
Impaired (Yes/No)	1.712	1.0577–2.7712	0.5377	0.2457	2.1881	0.0287
Educational level	0.9917	0.836–1.1765	-0.0083	0.0872	-0.0952	0.9241
Sex	1.2288	0.7273–2.0762	0.206	0.2676	0.7699	0.4413
Constant	-	-	-1.7419	0.5175	-3.3661	0.0008

CI, confidence interval; SE, standard error.

However, our finding on the possession of a driving licence is contrary to those of other studies. In the Port Harcourt study, almost all drivers (97%) possessed the document, whilst in Ilorin, only 0.5% of the drivers were driving without a licence.[10,14] As a matter of serious concern, we observed a low percentage of eye examinations being performed before the issuance of a driving licence. In our study, nearly half of the drivers (46.5%) had never had their eyes examined. Other studies corroborate this finding.[8,10,22] Worse still, a study in Ilorin observed that only 27.7% of respondents had their eyes examined before issuance of a driving licence.[12] Several studies have demonstrated that a high frequency of drivers had never had an eye examination performed before the issuance of a driving licence. Amongst these is another study carried out in Ilorin that observed that 84.5% of the drivers had never had an eye examination performed before issuance of a licence.[14]

About 8.3% of the drivers reported prior history of RTA. This result is significantly less than the prevalence of history of RTAs observed in other studies, which has been as high as 15.3%,[22] 16.2%,[23] 19.5%,[12] 20.8%,[14] 22.5%,[24] 26.2%,[18] 26.5%[8] and 45.5%.[10] This marked disparity may be attributed to the differences in the characteristics of the study populations. In our study, respondents were from a fairly random sample of drivers (commercial and private) from nearly all states of the federation, whereas in many other previous studies, respondents were purposefully commercial, government or private drivers in a particular city. Government drivers are generally assumed to be more careful and, in comparison, probably spent less time on the road than commercial and long-distance drivers. Another difficulty in the comparability of results may arise from the ways in which questions about accidents were framed.

On multiple logistic regression, analysis showed that visual impairment and age were significant predictors of RTA. Drivers with visual impairment were about two times (AOR, 1.7; 95% CI, 1.06–2.77) more likely to be involved in RTA compared with those without impairment. This corroborates past studies that demonstrated a statistically significant association between visual impairment and RTA involvement.[8,12,20,23]

However, several studies in the literature found no statistically significant relationship between visual impairment and RTA.[10,11,14] The difference in the findings of the present study and the aforementioned studies where no association was found between visual impairment and RTA perhaps could be attributed to the fact that many of these studies were descriptive in design and were not sufficiently powered to test hypotheses. Furthermore, strategies for handling confounders either at the design or analysis stage were rarely addressed.

Akateeba and Gyimah observed an association between age and violations of traffic rules, resulting in an increase in RTAs.[25] This is similar to our findings and those of other studies, where age was identified as a predictor for RTAs.[24] It is common knowledge that there are other human and non-human factors that contribute to RTA. We therefore recommended a study that would look at the attributable risk of all factors (human and non-human) responsible for RTA in Nigeria. In this study, the visual field of participants was assessed using the confrontational method, which is a limitation. Visual field analyser should be considered in future research.

Conclusion

This survey has shown a high prevalence of vision impairment amongst Nigerian drivers and that drivers with visual impairment were nearly two times more likely to be involved in RTA when compared with those without impairment.

The FRSC should work in collaboration with the Nigerian Optometric Association and other stakeholders to ensure that driving vision standards are maintained and reviewed as necessary.

We recommend, amongst other conditions, a vision of 6/12 (0.5, 20/40) or better in each eye or both eyes together (with corrective lenses if usually worn or required) on a well-illuminated, standard VA chart as one of the criteria for driving in Nigeria.

An eye health education campaign should be included in the regular sensitisation programmes organised by FRSC and should not be limited to commercial drivers only.

Acknowledgements

The authors thank the Nigerian Optometric Association board and members for providing financial, human and material support. They also thank the Federal Road Safety Commission of Nigeria for participating and collaborating with the Nigerian Optometric Association and the Federal and State Ministries of Health for collaborating.

Competing interests

There are no competing interests to declare.

Authors' contributions

B.N.E. was the lead author who researched and coordinated this study with D.E., who initiated the research. E.E. analysed the data and supported the human and material resources.

Funding information

Financial support from the Nigerian Optometric Association (NOA) came in the form of payment for material support like printing of questionnaires and reading glasses for drivers. Members of the NOA provided free services with their equipment.

Data availability statement

All data is contained in the article.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

References

1. World Health Organization. Injuries, traffic [homepage on the Internet]. World Health Organization; 2017 [cited 2019 Oct 21]. Available from: http://www.who.int/topics/injuries_traffic/en/
2. Federal Republic of Nigeria Official Gazette. National Road Traffic Regulation. Federal Road Safety Corps (n.d.). Safety requirements/guidelines for articulated lorries (tankers/trailers) operations in Nigeria [homepage on the Internet]. 2012 [cited 2019 Jan 10]. Available from: http://frsc.gov.ng/rtcenglish.pdf
3. Owoaje ET, Amoran OE, Osemeikhain O, Ohnoferi OE. Incidence of road traffic accidents and pattern of injury among commercial motorcyclists in a rural community in south western Nigeria. J Community Med Prim Health Care. 2005;17(1):7–12. https://doi.org/10.4314/jcmphc.v17i1.32418
4. Kunimatsu-Sanuki S. The role of specific visual subfields in collisions with oncoming cars during simulated driving in patients with advanced glaucoma. Br J Ophthalmol. 2016;101(7):896–901. https://doi.org/10.1136/bjophthalmol-2016-308754
5. Oladehinde MK, Adegbehingbe BO, Adeoye AO, Onakoya AO. Central nervous system stimulants: Effect on visual functions and occurrence of road traffic accidents. Ann Ital Chir. 2009;80(1):43–48.
6. Isawumi MA, Adeoti CO, Ubah JN, Oluwatimilehin IO, Raji RA. Ocular status of commercial drivers in Osun State, Nigeria. Afr J Med Med Sci. 2011;40(4):405–411.
7. Onabolu OO, Bodunde OT, Otulana TO, et al. Visual acuity of commercial motor drivers in Ogun State of Nigeria. Niger Postgrad Med J. 2012;19(4):225–229.
8. Chidi-Egboka NC, Bolarinwa OA, Awoyemi AO. Visual function test among commercial drivers in a North Central State of Nigeria. Health Sci J. 2015;9(6):1–7.
9. Boadi-Kusi SB, Kyei S, Asare FA, et al. Visual function among commercial vehicle drivers in the central region of Ghana. J Optom. 2015;9(1):54–63. https://doi.org/10.1016/j.optom.2015.06.004
10. Pepple G, Adio A. Visual function of drivers and it relationship to road traffic accidents in urban Africa. Springer Plus. 2014;3(1):47. https://doi.org/10.1186/2193-1801-3-47
11. Ovenseri-Ogomo G, Adofo M. Poor vision, refractive errors and barriers to treatment among commercial vehicle drivers in the Cape Coast municipality. J Afr Health Sci [serial online]. 2011 [cited 2018 Jan 10];11(1):97–102. Available from: https://www.researchgate.net/publication/51127352
12. Oladehinde MK, Adeoye AO, Adegbehingbe BO, Onakoya AO. Visual functions of commercial drivers in relation to road accidents in Nigeria. Indian J Occup Environ Med. 2007;11(2):71–75. https://doi.org/10.4103/0019-5278.34532
13. Brake. Driver eye sight survey 2014 [homepage on the Internet]. [cited 2019 Jan 10]. Available from: http://www.brake.org.uk/assets/docs/surveys/Eyesight%20Survey%20Report-Aug14.pdf
14. Adekoya BJ, Owoeye JFA, Adepoju FG, Ajaiyeoba AI. Visual function survey of commercial intercity vehicle drivers in Illorin Nigeria. Can J Ophthalmol. 2009;44(3):261–264. https://doi.org/10.3129/i09-049
15. Lwanga SK, Lemeshow S. Sample size determination in health studies: A practical manual. Geneva: World Health Organization Bulletin, 1999; p. 1–80.
16. Ekanem E, Ekpenyong BN. Conducting evidence-based research: Interventions and observational analytic studies. J Nigerian Optom Assoc [serial online]. 2019 [cited 2018 Jan 10];21(1):2–10. Available from: https://www.ajol.info
17. World Medical Association. World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191–2194. https://doi.org/10.1001/jama.2013.281053
18. Ojo PO, Patricia DW, Lodhip DV, Fati K. Prevalence of presbyopia, refractive errors and use of spectacles among commercial intercity vehicle drivers in Jos, Nigeria. J Med [serial online]. 2006 [cited 2018 Jan 10];6(1):37–41. Available from: https://www.ajol.info/index.php/jjm/article/viewFile/78878/69202
19. Vikas M, Pallavi A, Yogesh J. Prevalence of visual impairment among heavy vehicle drivers in Nagpur City. J Med Sci Clin Res [serial online]. 2014 [cited 2018 Jan 10];2(12):3304–3312. Available from: http://www.igmpublications.org/jmscr/v2-i12/31jmscr.pdf
20. Emerole CG, Nneli, RO. Visual indices of motor vehicle drivers in relation to road safety in Nigeria. Niger J Physiol Sci. 2013;28;(1):57–62.
21. Cleen Foundation. Survey on driver's license application and renewal in Nigeria [homepage on the Internet]. 2015 [cited 2018 Jan 10]. Available from: http://www.cleen.org/SURVEY%20ON%20DRIVERS%20LICENCE%20APPLICATION%20AND%20RENEWAL%20IN%20NIGERIA%202015.pdf
22. Biza M, Mossie A, Gelaw Y, Woldemichael K. Visual impairment and road traffic accidents among drivers in Jimma Town, SouthWest Ethiopia. Ethiop Med J [serial online]. 2013 [cited 2018 Jan 10];51:123–132. Available from: https://visionimpactinstitute.org/research/visual-impairment-road-traffic-accidents-among-drivers-jimma-town-southwest-ethiopia/
23. Bekibele CO, Fawole OI, Bamgboye AE, Adekunle LV, Ajav R, Baiyeroju AM. Risk factors for road traffic accidents among drivers of public institutions in Ibadan, Nigeria. Afr J Health Sci. 2007;14(3):137–142. https://doi.org/10.4314/ajhs.v14i3.30860
24. Samuel BB, Samuel K, Federick AF, Awuah A, Charles DT, Andrew OA. Visual function among commercial drivers in the central region of Ghana. J Optom. 2016;9:54–63. https://doi.org/10.1016/j.optom.2015.06.004
25. Akateeba MA, Gyimah AR. Drivers' attitude towards traffic safety violations and risk taking behavior in Kumasi: The gender age dimension. Int J Traffic Transport Eng. 2013;3(4):479–494. https://doi.org/10.7708/ijtte.2013.3(4).10