



Visual indices of motor vehicle drivers in relation to road safety in Nigeria

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Summary: This study assessed the visual profile of motor vehicle drivers in Owerri, Nigeria and to analyse the relationship between the various aspects of visual function in relation to road safety. A cross-sectional descriptive study of 150 commercial vehicles drivers and 130 private vehicles drivers was conducted between November 2005 and February 2006. Data were obtained using structured interviewer administered questionnaires and clinical examination was done. Standards procedures were used to determine visual indices. Data from the better eye (eye with a better visual acuity according to international and national standards) were reported, except in the analysis of near vision of the respondents. Twenty percent of the study group had normal visual acuity of $\geq 6/6$ compared with 46.2% in the control group. The tonometric value in 88.0% and 93.1% of study and control groups respectively was less than 24mmHg. Both groups (96.8%) had normal confrontation visual field while 95.3% of study group and 97.7% of control group had normal colour vision. The most prevailing eye conditions that may reduce visual acuity were pterygium (51.3% in study group and 13.8% in the control group), retinopathy (16.7% of study group and 6.2% of control group) and glaucoma (12.0% and 6.9% of study and control groups respectively). Nineteen percent of the study group had regular eye examination compared with 38.5% in the control group. Alcohol consumption was 64.7% in the study group and 32.3% in the control group. Most of the commercial motor drivers in Owerri, Nigeria did not meet the Federal Road Safety Commission visual acuity standard for commercial motor drivers. Visual impairments and poor visibility are strongly associated with RTA among Nigerian motor vehicle drivers. Visual acuity and visual health care were poor among commercial motor drivers. There is need for renewed efforts to enforce a compulsory periodic visual examination for drivers, and to ensure that visual requirements for driving are met.

Keywords: Drivers, Visual acuity, Road safety, Road traffic accidents, Nigeria

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INTRODUCTION

Road traffic accidents (RTAs) are causing increasing number of morbidity and mortality. RTA remains a dreadful plague the world over. The trend has been on a decline in most developed countries, while the reverse is the case in the developing nations. Indeed due to the ever increasing rate of road traffic accidents globally, the year 2004 was dedicated as "Road safety" by World Health Organization. This increase may, among other causes, be due to the increasing number of vehicles in our cities and inadequate visual test of vehicle drivers. Good vision is required for road safety and enhanced driving performance. RTA is endemic in Nigeria, with seasonal epidemics (Asogwa, 1978). The Nigerian Police Force records show that between 1980 and 1989, a total of 98,168 Nigerians died and 244,864

were injured in RTA (The Nigeria Police Force Management Service and Research Department, 1989). In spite of the concerted efforts at reducing the rate of RTA, Nigeria still ranks among the highly affected Nations of the world (Agunloye, 1988). It is even more disturbing to note that the young adult groups, the economic backbone of a Nation, is most affected by the ravaging menace (Asogwa, 1980).

In 1990, Nigeria's Federal Road Safety Commission (FRSC) produced a scheme for drivers' license which expects private motor vehicle drivers to have visual acuity of at least 6/12 in the better eye and 6/36 in the poorer eye. For commercial vehicle drivers, the minimum visual acuity would be 6/9 in the better eye and 6/24 in the poorer eye (Eke et al, 2000). This study is therefore conducted to assess the visual profile of vehicle drivers in Owerri, Nigeria and to analyse the relationship between various aspects of visual function in relation to road safety.

MATERIALS AND METHODS

Ethical approval for the study was obtained from Ethical Committee of College of Medicine and Health Sciences of the Abia State University, Uturu while consent was obtained from Imo Transport Company (ITC) Management and the respondents. A cross-sectional descriptive study was then carried out between November 2005 and February 2006 among drivers in Owerri, Nigeria. One hundred and fifty ITC drivers were selected from a sample frame of 300 using simple random technique. These represented the commercial vehicle drivers. For private vehicle drivers, 130 people were selected from the municipal using multistage technique. Data on socio-demographic characteristic were obtained using structured questionnaires administered by 2 trained research assistants.

Eye examinations (external eye examination, visual acuity tests, tonometry, visual field tests, colour vision tests and ophthalmoscopy) were done. External examination of the eye was done (to rule out presence of inflammations, infections, etc). For visual acuity Snellen's test chart, each eye was measured separately with or without glasses where applicable. Normal visual acuity is taken as $20/20$ ($6/6$) while visual acuity of $20/100$ ($6/30$) is considered subnormal. Tonometric values of 9mmHg to 24mmHg were taken as normal while tonometric values >24 mmHg were considered clinically significant. Visual fields of respondents were estimated by the confrontation visual field method. Colour vision assessment was by the Ishihara test and internal eye exam was by direct ophthalmoscopy. There was high correlation between the fellow eyes ($P<0.001$), and because the results based on right and left eyes were similar, data from the better eye (eye with a better visual acuity according to international and national standards) were reported, except in the analysis of near vision of the respondents

RESULTS

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

The age range for the vehicle drivers was 20 - 60 years. Most, 102 (68.0%) of commercial drivers and 84 (64.6%) of private drivers were aged 30-49 years. About 134 (89.3%) and 108 (83.1%) of commercial drivers and private drivers respectively were married. All the respondents had at least primary education

while 102 (68.0%) of commercial drivers and 64 (49.3%) of private drivers had 10 or more years of driving experience. Also, 112 (74.7%) and 22 (16.9%) of commercial drivers and private drivers respectively put up to 5 hours or more daily on driving. Ninety-seven (64.7%) and 42 (32.3%) of respondents in the study and control groups consumed alcohol. Majority of the respondents 132 (88.0%) and 118 (90.8%) were non- smokers. Only 28 (18.7%) and 50 (38.5%) of commercial drivers and private drivers respectively undergo eye examination at least once in two years. Majority of the respondents in the study group 70 (46.7%) and 9 (6.9%) of respondents in the control group were in the habit of using herbs. The differences in the drug history between the study and control groups were statistically significant. Seventeen (11.3%) and 63(48.5%) of commercial drivers and private drivers respectively use eye glasses (Emerole, 2006).

VISION OF RESPONDENTS

The visual acuity (VA) at far in the better eye for most of the respondents in the study group (28.7%) was 6/12 and in the better eye of 25.4% of the control group, 6/5. The differences in VA at far of the eye with a better visual acuity according to international and national standards for study and control groups were statistically significant ($p \leq 0.001$). The VA at near for most of the respondents was between N_6 to N_{18} . More respondents in the control group (17.7%) had a near VA of N_5 . The differences were statistically significant (a large proportion of the drivers had poor visual acuity for both far and near objects and this was significantly worse with the commercial drivers). Twelve per cent and 6.9% of commercial and private vehicle drivers respectively had tonometric values ≥ 26 mmHg. About 3.1% of the drivers had restricted visual field while 7 (4.7%) and 3 (2.3%) of both commercial and private drivers respectively had colour vision deficiency.

EYE CONDITIONS OF RESPONDENTS

The commonest external eye condition among commercial drivers was pterygium; 77 (51.3%) while for private drivers it was redness of the eyes, 21 (16.2%). Just a few of the commercial drivers, 8(5.3%) did not have any apparent external eye diseases. However, most of the private drivers, 87 (67.0%) did not have any apparent external eye disease. The observed external eye conditions in the commercial drivers was significantly worse than those of the private drivers ($P=0.000$). When the internal eyes were examined, the commonest conditions were retinopathy, 25 (16.7%) and glaucoma, 9 (6.9%) among commercial and private

Table 1. Visual acuity, field and colour vision of drivers

Visual acuity at far (in the better eye)	Commercial vehicle drivers N= 150	Private vehicle drivers N= 130
≥6/9 for commercial drivers or ≥6/12 for private drivers (acceptable vision)	64 (42.7)	114 (87.7)
<6/9 for commercial drivers or <6/12 for private drivers (unacceptable)	86 (57.3)	16 (12.3)
$X^2=60.97, df=2, P=0.000$ (significant)		
Visual acuity at near		
N ₅ and above (acceptable)	11(7.3)	23(17.7)
Less than N ₅ (unacceptable)	139 (92.7)	107 (82.3)
$X^2 =7.01, df=2, P=0.008$ (significant)		
Visual field		
Normal	145 (96.7)	126 (96.9)
Restricted	5 (3.3)	4 (3.1)
Fischer exact= 1.000 (Not significant)		
Color vision		
Normal	143 (95.3)	127 (97.7)
Color deficient	7 (4.7)	3 (2.3)
Fischer exact: P=0.348 (not significant)		

Table 2. External eye conditions of vehicle drivers

External eye conditions	Commercial vehicle drivers: N= 150 (%)	Private vehicle drivers: N= 130(%)
Ptosis	1 (0.7)	0 (0.0)
Stabismus/squint	0 (0.0)	1 (0.7)
Corneal Scarification	3 (2.0)	3 (2.3)
Blepharochalasis	1 (0.7)	0 (0.0)
Trichiasis	1 (0.7)	0 (0.0)
Pterygium	77 (51.3)	18 (13.8)
Red eyes	59 (39.3)	21 (16.2)
Nil apparent disease/ pathology	8 (5.3)	87 (67.0)
	150 (100.0)	130 (100.0)

$X^2 = 123.59, df = 7, P=0.000$ (significant)

Table 3. Internal eye conditions of vehicle drivers

Internal eye conditions	Commercial vehicle drivers: N= 150 (%)	Private vehicle drivers: N= 130 (%)
Iritis	2 (1.3)	0 (0.0)
Cataract	4 (2.7)	3 (2.3)
Retinopathy	25 (16.7)	8 (6.2)
Glaucoma	18 (12.0)	9 (6.9)
Nil apparent disease/ pathology	101 (67.3)	110 (84.6)
	150 (100.0)	130 (100.0)

$X^2 = 12.92, df= 4, P= 0.012$ (significant)

drivers respectively. Also, there were significantly more internal eye conditions affecting the retina observed among the commercial drivers than in the private drivers (P=0.012).

ROAD TRAFFIC ACCIDENT HISTORY (RTA HISTORY)

Majority, 119 (79.3%) in the study group had a RTA history. The differences were statistically significant. In 48 (40.3%) and 36 (70.6%) of study and control groups respectively, poor visibility was cause of their involvement in RTA. Most of the RTAs occurred between October to December period [in 64 (53.8%) and 25 (49.0%) of study and control groups

respectively] and least during January to March [10 (8.4%) and 4 (8.0%) of study and control groups respectively]. In the study group, 36 (30.3%), the RTAs occurred more in the mornings while in the control group, 23 (45.1%), their involvement in RTAs was in the evenings. The differences were statistically significant (Emerole, 2006).

DISCUSSION

Globally, injuries from road traffic accidents are a major public health problem. Each year, an estimated 1.2 million people are killed in road accidents and as many as 50 million suffer various forms of injuries (Asogwa, 1999; Nwachukwu, 1998). These figures

could increase by more than half over the next 20 years unless there is a firm commitment to road safety and accident prevention, especially in developing countries. Majority of the respondents were aged 40-49 years and this may explain why over 65% of the respondents had near vision of N₅ or less. This is in agreement with the fact that all parameters for assessing visual function decreases with age (Berger et al, 1999; Borish, 1975; Isler et al, 1997; Janke, 1994). In the present study, private vehicle drivers were significantly better educated than commercial vehicle drivers and this may explain why they also had more periodic (at least once in two years) eye examination than commercial vehicle drivers since their level of health awareness may be higher. Another reason for better educational attainment and more frequent eye check may be because private vehicle drivers are often of higher socioeconomic status. The majority of the respondents of the study group consumed alcohol. This was not the case for respondents in the control group. This may explain the higher record of RTAs in the study group. It has been amply demonstrated that alcohol is a significant cause of fatality, not only of drivers and riders but also of pedestrians (Adetunji, 2003; Kanellaidis, 1999; Mcleans et al, 1987; Onakomaiya, 1979).

The results of this study have further shown that a good number of commercial motor drivers in Nigeria operate their vehicles with vision below the legal requirement for driving (Alakija, 1981; McMoli and Ogunmekan, 1983). In the present study, there was a significant difference in the prevalence of vision \leq 6/12 at far between the study group (57.3%) and the control group (30.0%). Alakija(1981) in a study of randomly selected drivers in Benin City reported a prevalence of 31.7%. McMoli and Ogunmekan (1983) in a similar study in Lagos obtained a prevalence of 9.1%. However, the sampling method used in selecting the drivers was not stated. Alakija, (1981); McMoli and Ogunmekan, (1983) used a higher cut-off level than those stipulated by Federal Road Safety Commission level of 6/9 in the better eye and 6/24 in the poorer eye for commercial drivers, which came into existence some years later, and the minimum visual acuity standards of 6/12 in the better eye and 6/36 in the poorer eye for private motor vehicle drivers (Eke et al, 2000).

Respondents in the study group had a poorer visual acuity at far and near. The Federal Road Safety visual acuity standard for private drivers is at least 6/12 in the better eye and 6/36 in the poorer eye. For commercial vehicle drivers, the minimum standard is 6/9 in the better eye and 6/24 in the poorer eye (Eke et al, 2000). In the course of this study, it was observed that most respondents in the study group did

not meet the Federal Road Safety visual acuity standard for commercial vehicle drivers.

The prevalence of visual field restrictions estimated by confrontation method was 3.3% and 3.1% in the commercial drivers and private drivers respectively. McMoli and Ogunmekan (1983) did not state the prevalence of visual defects in their study. Nevertheless, they noted that 4.7% of the drivers had permanently impaired vision, cataract, healed choroiditis, optic atrophy and glaucoma-lesions known to be associated with visual field defects. Visual field (VF) is another visual parameter but VF tests are yet to be incorporated into the requirements for issuance of driving license in Nigeria. In this study, there was no significant association between visual field defects and RTA history. Confrontation method, though less precise than perimetry, is especially useful for mass visual field screening. There was no case of colour blindness in respondents in the two groups. The prevalence of color vision deficiency was 4.7% of the study group and 2.3% of the control group. The drivers investigated by McMoli and Ogunmekan had no color vision defects. Most cases of color vision defects are inherited and the prevalence has a racial variation. Generally, higher prevalence rates are recorded in Caucasians than in Negros (Alakija, 1981; McMoli and Ogunmekan, 1983). Colour perception is necessary to identify traffic lights (green, red, and yellow) or even car lights. It may be drug-induced (isoniazid) and is not associated with dust exposure (Borish, 1975).

Conjunctivitis was the most reported eye condition by the respondents. This may be because of the anatomical location of the conjunctiva of the eye (Borish, 1975). Significantly, greater proportion of commercial drivers had conjunctivitis when compared to private drivers. This may be due to longer period of exposure of the eyes to dusts and irritants on the road. The commercial drivers spend longer period driving on the road than the private drivers. Previous researchers have observed that many commercial drivers in Nigeria drive their vehicles with vision below the legal requirement for driving (Alakija, 1981; McMoli and Ogunmekan, 1983). Present study observed high prevalence of nationally unacceptable visual acuity at far for both commercial and private drivers (visual acuity of less than $\frac{6}{9}$ for commercial drivers and $\frac{6}{12}$ for private drivers) (Eke et al, 2000). A study among randomly selected drivers in Benin-City reported a prevalence of 31.7% among taxi drivers (Alakija, 1981) while another study in Lagos obtained 9.1% (McMoli and Ogunmekan, 1983). The relative low incidence obtained in Lagos may be because of a higher cut-off level for acceptable visual acuity was used.

In the course of external eye examination, it was observed that majority of the respondents had

pterygium and red eyes (51.3% and 39.3% of commercial drivers and 13.8% and 16.2% of private drivers respectively). Drivers, especially commercial drivers are often exposed to dusts and other eye irritants. This further confirms that constant exposure of eyes to the Sun, dust and irritants are causative factors for pterygium and redness of eyes (Borish, 1975). The total prevalence of internal eye conditions like cataract, glaucoma, iritis and retinopathy known to affect vision was 32.7% among commercial drivers while it was 15.4% among private drivers. The difference may be due to increased exposure of the eyes to harsh weather conditions among commercial drivers and also their ignorance of the benefits of periodic eye examination.

Many respondents with subnormal vision were shocked and worried on full realization of their eye problem. The majority of the respondents in the study group were in the habit of consuming herbs. This may explain the higher incidence of retinopathy in the study group in relation to the control group (McMoli and Ogunmekan, 1983). This is perhaps not surprising in a society where eye care services are not well organized especially at the primary health care level. The visual history of the respondents revealed that more respondents in the control group went for periodic eye examination. Greater health awareness was observed in the control group. This may be due to higher educational attainment and socialization of the respondents in the control group. Many people, whose eye defects cause neither pain nor socially embarrassing symptoms, may be going about their business oblivious of their ocular problem.

A statistically significant difference in years of driving experience, daily duration of work schedule and history of RTAs between the two groups were reported. The higher records of RTAs in the study group may be due to their longer period of exposure on the road and the fact that RTAs may be taken as one of the occupational hazards for commercial drivers and road users.

In this study, poor visibility was given by respondents as major cause of involvement in RTAs (40.3% and 70.6% for study and control groups respectively). A significant loss of visual function, such as VA, VF or colour vision will diminish a person's ability to operate a motor-vehicle safely on today's congested, high-speed roadway (CCMTA-CCATM medical standard for drivers, 2004; Goodie et al, 1998; Legotetis and Sheinberg, 1996; McGwin et al, 2004; Owsley et al, 1999; Szlyk et al, 1992).

The diurnal variation in occurrence of RTAs between the respondents in the two groups showed that the RTAs occurred mostly in the mornings (study group) and evenings (control group) during rush periods to commence and close activities for the day. The mean prevalence of history of occurrence of

RTAs and visual impairments for the two groups in this study implicates poor vision as a causative factor in the occurrence of RTAs and further shows effect of visual impairments on road safety (Asogwa, 1999; CCMTA-CCATM medical standard for drivers, 2004; Rosenberg et al, 1998; Wood and Troutbeck, 1994).

This study has revealed that most of the commercial motor vehicle drivers in Owerri, Nigeria did not meet the Federal Road Safety Commission visual acuity standard for commercial motor drivers. Similarly, the level of their visual care and health awareness were poor.

Pterygium and retinopathy which are degenerative conditions of the eye, and capable of affecting vision were the most observed eye conditions among the drivers. Many of them were in the habit of consuming excessive alcohol which is known to damage the optic nerve. Also, majority of the drivers were in the habit of using herbs for the treatment of malaria which may result in maculopathy and visual loss. Poor vision and reduced environmental visibility were associated with more frequency of road traffic accidents. It is recommended that wearing of safety goggles should be made compulsory for all commercial drivers as well as public enlightenment should be intensified on the consequences of unhealthy habits to driving and road safety.

REFERENCES

- Adetunji J.O. (2003): Zebra Crossing and Pedestrian safety management in Road Traffic Environment in Metropolitan Lagos Nigeria. Measures and their effects. 15th ICTCT Workshop, pp 1-8
- Agunloye O (1988): Road danger in Nigeria-Truth and consequences. *J. Fed. Road Safety Commission, Nigeria*; 1: 11-6.
- Alakija W. (1981): Poor visual acuity of taxi driver as a possible cause of motor traffic accidents in Bendel State, Nigeria. *J. Soc. Occup. Med.*; 31: 167-170
- Asogwa S.E (1978): Road traffic accidents: a major public health problem. *Public Health*; 92: 237-45.
- Asogwa S.E (1980): Some characteristics of drivers and riders involved in road traffic accidents in Nigeria. *East Afr. Med J*; (57); 399-404.
- Asogwa S.E (1999): A handbook for all road users (1st edition). Enugu SNAPP Press Ltd.11-79.
- Berger J.W, Fine S.L, Maguire M.G (1999): Age-related Macular Degeneration, St. Louis, Mosby.
- Borish I.M (1975): Clinical Refraction (3rd edition). The professional Press Inc. Chicago, Illinois. Pp 5-694.

- Canadian Council of Motor Transport Administration CCMTA-CCATM medical standard for drivers (2004): *Medical standard for drivers*.pp1-46.
- Eke N, Etebu E.N, Nwosu S.O(2000): Road traffic accident mortalities in Port Harcourt Nigeria. *Anil Agrawal's Internet Journal of Forensic Medicine and Toxicology*; 1-2.
- Emerole C.G (2006): Visual Profile of Commercial Motor Drivers in Owerri, Nigeria. M.Sc (Human Physiology) Dissertation. Abia State University, Uturu
- Goode K.J, Ball K.K, Sloame M (1998): useful field of view and other Neurocognitive indicators of crash risk in older adults. *J. Clinical Psychology in Medical settings*; 5: 25-440
- Isler R.B, Parsonson B.S, Hansson G.J(1997): Age-related effects of restricted head movement on the useful field of view of drivers. *Accid. Annal Prev*, 29(6) 793-801.
- Janke M (1994): Age-related disabilities that may impair driving and their assessment. Cooperative agreement between USDOT/NHTSA and CADMY. Contract No. DTW W22-9, 5 Sacramento, California.
- Kanellaidis G (1999): Pedestrian safety problems and implementation of counter measures. *Journal of International Association of Traffic Safety Sciences (IATSS)* 23:2, Japan.
- Legotetis N.K, Sheinberg D.L (1996): Visual object recognition. *Ann. Rev Neurosci*. 19: 577.
- McGwin G, Mays A, Joiner W, Decarlo D.K, McNeals, Owsley C (2004):Is glaucoma associated with motor vehicle collision involvement and driving avoidance? *Invest-Ophthalmol Visual Sci*. 3934-3939.
- Mcleans S, Parsons R.S, Chesterman R.B, Dinear R, Johnson M.G, Davies N.W(1987): Drugs, Alcohol and Road accidents in Tasmania. *Med. J*. 147: 6-11.
- McMoli T.E, Ogunmekan D.A(1983): Road traffic accidents in Nigeria-Observation on controllable human factors in Lagos. *Afr. Ann of Med.*; (1): 30-33.
- Nwachukwu C.(1998): Road Safety laws and Regulations (problems of enforcement) in Road Safety and Accident Reduction in Nigeria. A blueprint for the year 2010. Proceedings of a National workshop. Osagie and co-workers (Ed.) National Institute Press Kuru.
- Onakomaiya S.O (1979): Pedestrian Safety- A neglected aspect of Road transportation in Nigeria. Proceedings of Nigerian Institute of Social and Economic Research (NISER) Staff Seminar (E.C Ndekwa) Ed. Ibadan.
- Owsley C, Stalvey B, Wells J, Sleane M.E (1999): Older drivers and cataracts: Driving habits and crash risk. *J. Gerontol. A Biol Sci Med. Sci*. 54A: M203-M211.
- Rosenberg W.J, Aiello P.L, Kuperwisher C.M, Berson G.F (1998): Visual Requirements and Commercial Drivers, pp1-17.
- Szlyk J.P, Alexander K.R, Severing K, Fisherman G.A (1992): Assessment of Driving performance in patients with retinitis pigmentosa. *Arch ophthalmol*.110: 1709-1713.
- The Nigeria Police Force Management Services and Research department (1989): Data on establishment of force. Force Headquarters Lagos, p 1-19.
- Wood J.M, Troutbeck R (1994): Effect of visual impairment on driving. *Hum Factors*; 36: 476-485.
- Wood J.M, Mallan K(2001): Comparison of driving performance of young and old drivers (with and without visual impairment) measured during in traffic conditions. *Optom.Vision Sci*. 78:343-349.
- World Health Organization (WHO), (2004) World Health Day: Road Safety is no accident! WHO and World Bank Joint Report 07 April, 2004, WHO, Geneva, 1- 4. <http://www.who.int/world-health-day/previous/2004/en>. cited 5/31/2013.