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An Assessment of the Visual Acuity and Contrast Sensitivity of Commercial Vehicle Drivers in Rivers State, Nigeria

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ABSTRACT

This study was carried out in Rivers State, Nigeria to ascertain the level of visual and contrast sensitivity of commercial vehicle drivers. One hundred commercial drivers all of whom were males were used for this study. The mean age of the drivers was 42.62±10.34. The visual acuity test using the snellen chart was done at 6 meters and the contrast sensitivity testing was done at 1m using the Pelli- Robson contrast sensitivity chart. Results obtained showed that 80% of the drivers had a normal visual acuity of 6/6 in the better eye and 85% of the drivers had a normal contrast sensitivity. Data analysis with the SPSS statistical software using the Pearson product moment correlation coefficient showed that there was a positive correlation between visual acuity and contrast sensitivity at 0.05 level of significance [r = 0.415, n = 100, p (0.000) < 0.05]. Routine eye checkup annually to examine the visual functions of commercial drivers before renewal of driving license is recommended.

Keywords: Visual acuity, Contrast sensitivity, Drivers, Accident

INTRODUCTION

Driving is the primary means of travel in many countries. It facilitates the performance of routine daily activities and it is thus integrated with the concept of quality of life [1]. In Africa, driving a car is still considered a privilege, an enviable option with inherent responsibilities. In Nigeria, commercial vehicles are operated as business ventures. However, concern had been expressed about the poor conditions of some vehicles plying Nigerian roads most especially commercial vehicles. A commercial vehicle is any type of motor vehicle used for the transportation of goods and paid passengers. Examples of commercial vehicle include trucks (articulated lorry), vans, coaches, buses, taxicabs, trailers and box truck [2]. Safety on the roads has been a recurring source of concern to the average Nigerian. Human factors are a significant cause of Road Traffic Accidents (RTAs). To this end, the driver is seen as a major player concerning issues of safety on our roads. It is therefore pertinent to examine some of those factors in the driver that may increase or reduce his chances of RTAs. Driving is inarguably a high visual task which requires several sets of abilities which include sensory ability and compensatory abilities [3]. Even though visual acuity is the ubiquitous screening test during

application for a driver's license, many other aspects of visual function and visual processing are undoubtedly involved in supporting the effective control of a vehicle. During the last two decades there has been a burst of research activity focused on the role of vision in driving, much of which has been centered on what types and degrees of vision impairment hamper driver safety and performance. However, it is important to acknowledge that driving is not simply just a way to get around, but in fact is the primary and preferred mode of travel for everyone in Nigeria and many other African countries [4]. Being a driver has a profound impact on health and well-being. It also creates a need for alternative transportation options at both the societal and individual level that are potentially expensive and are unavailable in many geographic areas, especially rural areas[5]. Just as reading in a literate society is important to quality of life, so is driving in a society that depends on the personal vehicle for transportation and those that depend on it as means of survival. Good visual function is essential for safe driving. Any significant loss of a visual function, such as visual acuity, contrast sensitivity or visual field will diminish a person's ability to operate a motor vehicle safely on today's congested, high-speed roadways. A driver with a marked visual defect may fail to perceive a potentially dangerous situation altogether or see it too late to react appropriately. Driving is a visually intensive task which requires several sets of abilities which include sensory ability (mainly visual), mental ability, motor ability and compensatory abilities. One needs different kinds of vision to be able to drive safely. Any significant loss of visual function such as visual acuity or visual field will diminish a person's ability to operate a motor vehicle safely on today's congested high-speed roadways.

Visual acuity is a measure of the spatial resolution of the visual processing system. By definition, the term visual acuity refers to an angular measurement relating testing distance to the minimal object size resolvable at that distance [6]. Visual acuity can be expressed in different notations which include feet, meters, decimal, Logmar and Jaegar. The use of visual acuity for screening for initial and periodic licensure for driving has face validity. It is the choice of ophthalmologists and optometrists when assessing the integrity and health of the visual system and the primary visual function is evaluated during a comprehensive eye examination. Road signs in the U.S are designed based on sight distances assuming that drivers have at least 20/30 or 6/9 binocular visual acuity [7]. Drivers with visual acuity worse than that level are likely to have difficulty reading highway signage such as speed limit signs, stop signs, exit signs on the interstate at distances deemed safe for making vehicle control decisions [8]. One important consideration is that visual acuity related performance do not translate into reduced safety. That is, visual acuity-related driving skills (e.g. sign recognition) may not be crucial to the safe operation of a vehicle. Reading signage may be important for route planning or maintaining regulatory compliance with the "rules of the road" but it may not be critical for collision avoidance. Another consideration is that visual acuity testing does not measure the visual skills necessary for the safe operation of a motor vehicle. Visual acuity tests were originally designed for the clinical diagnosis and monitoring of primary and secondary tasks, all in the midst of a visually cluttered environment where critical events occur with little or no advance warning.

Contrast sensitivity testing complements and extends the assessment of visual function provided by simple acuity tests. At the cost of more complex and time-consuming procedures, contrast sensitivity measurements yield information about an individual's ability to see low-contrast targets over an extended range of target size (and orientation) [9]. People with reduced contrast sensitivity may experience difficulty with driving, inspite of having

visual acuity to drive. However, it is unclear at this time what level of reduction in contrast sensitivity represents an unacceptable risk for driving. Patients should be made aware of any significant reduction in contrast sensitivity. A person who has poor contrast requires a higher contrast to see objects or patterns from a person who has good contrast sensitivity. Impairment of contrast sensitivity can result from a number of different eye and neurological conditions e.g. cataracts, macular degeneration, diabetic retinopathy, brain injury, stroke, trauma or tumor, diplopia and uncorrected refractive error [10]. However, in an evaluation of contrast sensitivity as a screening test at licensure renewal in California, those who failed the screening test were more likely to incur future crashes as compared to those who passed [11]. The significant association between contrast sensitivity deficits and crash risk observed by may reflect the increased representation of drivers with significant contrast sensitivity impairments. Contrast sensitivity measured under photopic conditions was a better predictor of the recognition of road signs, obstacles and pedestrians while driving at night than was photopic visual acuity [11]. A reduced contrast sensitivity can prevent an intoxicated driver from detecting obstacles in his field of view in some situations. A reduction in contrast sensitivity combined with changes in ocular-motor control and attention deficits may have a strong effect on performance while under the influence of alcohol [12]. In more unfavourable conditions, such as fog at night, alcohol can reduce the visibility of an object to the point of being below the threshold of detectability. Commercial vehicles between the ages of 20 and 50 are expected to have a log contrast sensitivity of 1.80 and above, and those below 20 years and above 50 years are expected to have a log contrast sensitivity of 1.65 and above.

MATERIALS AND METHODS

This study was a descriptive study to assess the visual acuity and contrast sensitivity of commercial vehicle drivers who ply the roads of Rivers state, Nigeria. The drivers were assembled at designated motor parks across the state. Only drivers willing to give a written consent were selected for this study. A case history was first carried out and then the visual acuity test using the snellen chart was done at 6 meters with the drivers wearing their prescription glasses for driving. The visual acuity was recorded for both the right and left eye. Contrast sensitivity testing was done at 1m using the Pelli- Robson contrast sensitivity chart. The data was then uploaded into the SPSS version 17 statistical software for analysis.

RESULTS

A total of 100 commercial vehicle drivers all of whom were males were used for this study. Their ages ranged from 21 to 72 years with a mean age of 42.62 years and a standard deviation of 10.34. The age range distribution of the drivers is shown in table 1. The age range of 40 – 49 had the highest percentage frequency of 34 %. In summary, 74% of the drivers were below 50 years and only 2% were above 70 years. Summary of the data on working experience of the drivers showed that 90% of the drivers had below 30 years of working experience (Table 2). The habitual visual acuity of the drivers was taken at 6 meters and results showed that 80% of the drivers had a normal visual acuity of 6/6 in the better eye. 17% had a visual acuity of between 6/9 and 6/24 while 3% had a very poor visual acuity of below 6/60. This is shown in table 3. Results of the Logmar contrast sensitivity showed that for drivers between ages 20 to 50, 83.33% had a normal contrast sensitivity of 1.80 and above while 16.67% had below 1.80. For drivers who were either below 20 years or above 50 years, 93.75% had a normal contrast sensitivity of 1.65 and above while 6.25% had below 1.65. In

summary 85% of the drivers had a normal contrast sensitivity. Data analysis with the SPSS statistical software using the Pearson product moment correlation coefficient showed that there was a positive correlation between visual acuity and contrast sensitivity at 0.05 level of significance [r = 0.415, n = 100, p (0.000) < 0.05].

DISCUSSION

Commercial vehicle driving in Nigeria is a male dominated profession such that all the commercial vehicle drivers seen in the area of study were all males. Majority of these drivers were in the productive ages of between 30 and 60 years. Beyond this, the body begins to weaken and eye sight begins to deteriorate causing these drivers to retire from their profession. From table 2, 28% of the drivers had less than 10 years working experience and 62% had 11 to 30 years working experience. Omolase et al., [13] in their study reported that most of the drivers in Nigeria had more than 10 years driving experience. The visual acuity of 80% of the drivers was normal and 3% of the drivers had a visual acuity below 6/60 in the better eye. The 3% with low vision have no business driving as they obviously cannot see very well and are very likely to cause accidents. Their sight would even be worse at night as there are no working street lights in most highways in Nigeria and any attempt to drive at night would most likely result in an accident. In contrast to this result, a study[14] in Cape Coast, Ghana revealed that over 12% of commercial vehicle drivers do not have the minimum visual acuity required for driving. Another study [3] in Nigeria showed that 3.3% of drivers had a visual acuity poorer than 6/18. The Logmar contrast sensitivity test carried out on the drivers showed that 85% of the drivers had a normal contrast sensitivity. The other 15% will find it difficult to make out images with similar color backgrounds as the contrast will be poor. This will be worse at night when all images will appear dark. These drivers will also find it difficult to read signs along the road with poor contrast.

Statistical analysis of this study showed a positive correlation of the visual acuity and contrast sensitivity of the drivers using the Pearson product moment correlation coefficient. Thus, drivers with a poor visual acuity most likely showed poor contrast sensitivity. Mantyjarvi [15] in their study reported that as the visual acuity of drivers worsen, so does the contrast sensitivity. Most of the commercial vehicle drivers are known to drive recklessly and when this is compounded with poor visual function, the risk of accidents is likely to be high. The road safety cooperation in Nigeria should ensure that only drivers who meet visual standards should be issued driving licenses and visual tests should be repeated before each renewal of driver's license as age has an effect on vision. Drivers who not licensed should be kept off the roads through regular patrols with offenders punished according to the law so that they do not return back to the roads without proper licensing. It is common to find drivers both commercial and private who do not have driving license or have an expired driving license driving daily with their vehicles. Even when they are caught by road safety authorities, they pay a fine and return back to the road. Studies [3,14] have shown a correlation between poor visual function and prevalence of road traffic accidents. Road safety authorities should continue to work hard to make our roads safe by ensuring that only drivers with proper visual function are allowed to drive. Compulsory ocular examination should be introduced as part of requirements for issuing and renewing driver's license and commercial vehicle drivers should undergo routine eye checkup at least once a year to ensure that their visual status is still in accordance with the normal visual acuity and contrast sensitivity.

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TABLES

Table 1: Age distribution of drivers

Age range	**Frequency**	**(%)**
20-29	10	10.0
30-39	30	30.0
40-49	34	34.0
50-59	22	22.0
60-69	2	2.0
Above 70	2	2.0
TOTAL	100	100

Table 2: Distribution of working experience of the drivers

Years of working experience	**Frequency**	**(%)**
1-10	28	28.0
11-20	33	33.0
21-30	29	29.0
31-40	8	8.0
41-50	2	2.0
TOTAL	100	100

Table 3: Distribution of best visual acuity of the drivers

Visual Acuity	**Frequency**	**(%)**
6/5 - 6/6	80	80.0
6/9 - 6/12	11	11.0
6/18 - 6/24	6	6.0
6/36 - 6/60	-	-
< 6/60	3	3.0
TOTAL	100	100

Table 4: Logmar contrast sensitivity of drivers

Logmar contrast sensitivity	**Frequency**	**(%)**	**Logmar contrast sensitivity**	**Frequency**	**(%)**
≥1.80	70	83.33	≥1.65	15	93.75
<1.80	14	16.67	<1.65	1	6.25
Total	84	100		16	100