VISION ASSESSMENT OF PUBLIC SERVICE VEHICLE DRIVERS IN GABORONE, BOTSWANA

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DECLARATION

I declare that this research proposal is my original work and has never been published or presented for a degree in any other University.

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LIST OF ABBREVIATIONS

BCVA	-	Best Corrected Visual Acuity
KNH	-	Kenyatta National Hospital
MOHW	-	Ministry of Health and Wellness
RE	-	Refractive Errors
RTA	-	Road Traffic Accidents
SPSS	-	Statistical Package of Social Science
UON	-	University of Nairobi
VA	-	Visual Acuity
VI	-	Visual Impairment
WHO	-	World Health Organization
AO clinic	-	Always Open clinic

ABSTRACT

Background:. Good vision is a vital element for safe driving and pertinent sensory factor that accounts for approximately 95% of all sensory requirements. Public service drivers (PSV) vision testing is done by a transport officer in Botswana which could be inadequate assessment. This study will help to create informed decisions on road traffic regulations and policy making regarding PSV drivers' vision assessment.

Objective: To assess the vision of public service vehicle drivers in Gaborone, Botswana.

Methods: This was a cross-sectional descriptive study involving 134 participants who were assessed at Always open clinic (AO) at Gaborone bus rank during the period of 15 March 2021 to 26 March 2021. Convenience sampling was used to select the participants. Permission and authority to conduct the study was sought from the Ethics and Research Committee of the University of Nairobi/Kenyatta National Hospital.

Results: The study found that 126 (94.0%) drivers had normal vision according to the WHO guideline and 109 (81.3%) met the visual requirement for driving a public service vehicle. There were 131 (97.7%) drivers who had prior eye examination. The commonest ocular disorders were presbyopia (27.6%),uncorrected refractive errors (22.4%), followed by cataract (7.4%), color vision defects (1.4%) and abnormal visual fields (1.4%). Twenty-five drivers (18.7%) had been involved in road traffic accidents (RTA).

Conclusion: Majority of the drivers had good vision and met the visual acuity requirements for driving a public service vehicle and there was no statistical significant association between visual acuity, color vision and confrontational visual fields and road traffic accidents occurrence.

Recommendations: There is need to do a larger similar study to compare association of vision and occurrence of road traffic accidents among PSV drivers comparing them with police records of accidents as this will provide a more accurate analysis.

PROBLEM STATEMENT

The World Health Organization gives a rough estimate of 1 billion people being visually impaired globally. In Botswana main causes of visual impairment are cataract (58.9%) and refractive errors (38.5%).[1] Public service drivers (PSV) are entrusted with the lives of many. Therefore, their vision should be good for them to drive well and avoid causing accidents. Botswana traffic act regulations has visual acuity requirements for PSV drivers; however, the vision testing is done by a transport officer and there is no detailed ocular examination done which may be insufficient assessment and may lead to missed diagnoses like cataracts and refractive errors; conditions that cause preventable blindness.

This study will help to create informed decisions on road traffic regulations and policy making regarding PSV drivers' vision assessment.

1.0 INTRODUCTION

The main mode of travel in Botswana is driving which enhances the performance of the daily routine activities. Most people rely on public service vehicles for transport. To be a public service driver in Botswana, one is required to have a valid driving license, a professional driving permit (PrDP) and a police clearance certificate confirming that one is not a criminal. A professional driving permit has three categories P (passengers), G (goods) and H (hazardous). An applicant for a PrDP undergoes a medical examination on initial licensure and after two years it is renewed with no medical examination being done.[2]

Driving is a visually intensive function that requires all motorists to have a legalminimum standard of vision.[3] Many countries across the globe conduct visual acuity assessment before issuing a driver with his/her first driving license. Initial assessment of

vision is considered to be a good practice when it comes to safe driving. Therefore, ascertaining good vision for public transport drivers among other things (physical,mental wellbeing) could help in ensuring the safety of drivers, passengers and other road users. It has also been established that, for most car accidents, sensory loss in drivers is a key risk factor.[4]

The number of usage of motor vehicles in Botswana annually is rising, accompanied by an increase in RTAs.[5] In 2018, the number of road accidents recorded in Botswana was 17,341, and 17,786 in 2017 with most of the accidents occurring in Gaborone and Gaborone West; both accounted for 26.6 percent of total accidents. Almost a third (28.7%) of the total accidents involved public service vehicles.[6] The annual accident statistics show that 54.8% of accidents were due to human error. The other causes include driver losing control (20.6%) pedestrian error (5.6%) and animals (5.5% .It is against this backdrop; experts suggest that vision plays a vital role in safe driving given that 95% of accidents are related to vision.[7]

2.0 LITERATURE REVIEW

2.1 Visual requirements for driving

The minimum visual requirements for driving license applicants vary from country to country. Botswana, Kenya, UK and Australia standards are discussed below:

In Kenya, the traffic Act requires the applicant to be in a position to read with glasses a motor vehicle identification plate at a distance of 25metres.[8] The Kenyan standard number plates have letters and figures that use 84mm in height. Given that the number plates should be 25m away, each letter subtends a visual angle of 13.3 minutes of arc. This is in line with the visual acuity of 6/9 or LOGMAR 0.2. In addition, before the

renewal of license by the driver it is important for one to be physically fit. Before the driving license is issued, visual fields are not required.

In the United Kingdom the simple visual mandatory requirement for the application of a driver's license is one's aptitude to read in good day light using corrective lenses if need be. In line with visual acuity of 6/10 Snellen acuity, a number plate is attached to a motor vehicle with letters and figures of 79mm high, 54mm in width at a distance of 20.5metres. Drivers must have 6/9 acuity in the better eye and 6/12 the worse eye with at least 120 degrees horizontal (Goldmann III4e setting or equivalent) and no significant deformity in the binocular field encroaching within 20 degrees above and under the horizontal meridian.[3] Monocular drivers are allowed to drive once advised clinically and have adapted to the disability by satisfying the visual acuity requirement with normal monocular visual field. Drivers with uncorrected diplopia and those with hemianopia are regarded as being unfit to drive public service vehicle.[3] The vision assessment is done by the Driver and Vehicle Licensing Agency that has qualified optometrists.

The visual requirement in Australia is acuity of 6/9 in the improved eye with not less than 6/18 in the other eye. All commercial motor vehicle drivers must have normal visual fields but conditional license can be given out if the binocular horizontal visual field is at least 140 degrees. Monocular drivers should not possess a commercial driver's license but be issued with a conditional license.[9] Vision assessment is done by optometrist.

In Botswana the number plate letters and numerals shall not be less than 75mm in height and the number plate to be fixed to a vehicle at a height of more than 1.5 meters above ground level. A professional driver permit holder shall have visual acuity, with corrective lenses if need be of not less than 6/7 Snellen acuity/ LOGMAR 0.1 in the

better eye and at least 6/12 in the worse eye.[2] The drivers´ horizontal field of vision can not be less than 120 degrees (which is done when patient is referred to an ophthalmologist). Visual acuity is done by the transport officer but when need occurs, drivers are referred to an ophthalmologist. Drivers with monocular vision and diplopia are regarded as being unfit for a professional driving permit.

Research findings have shown that some drivers are unable to meet the required minimum vision. A study done in Iran found a failure rate of 9%[10] while Jenning in Australia found a failure rate of 12%[11], Davidson in the UK found a failure rate of 4% , in Indonesia a failure rate of 13.5%[12] and 15.3 % in Nigeria.[7] Refractive error was the common cause of failure to meet minimum visual requirements.

2.2 Eye conditions affecting driving

Certain eye conditions have a significant impact on safe driving. These conditions include glaucoma, cataract, refractive errors, diabetic retinopathy, and age-related maculopathy.

2.2.1 Cataract

Cataract affects various elements of vision including visual fields and acuity. According to Owsley, older drivers with cataracts experience difficulty on the road and in most cases, they try to avoid difficult driving conditions like, driving at night, bad weather and rush hour traffic. It was established that drivers with cataract were almost three times more likely to be involved in RTA. According to a study done by Mwangi in 2001, approximately 5% of the drivers who participated in her study had cataracts and a significant correlation was established between driver's vision and RTAs ($p=0.007$).[13] A study involving vision assessment of long distance public service drivers in Nairobi in

2018 found that 2.7% PSV drivers had cataract and most of them were associated with RTA(p value 0.056).[14]

2.2.2 Uncorrected Refractive errors

Visual impairment has been found to be caused by refractive errors across the globe. A study done in Pakistan on bus drivers found that 52% of drivers had uncorrected refractive errors and a strong association with RTA was established.[15] Refractive errors unawareness and their consequences were revealed among drivers by Khalila who reported that, in Nairobi 36.2% of drivers had refractive errors and most drivers with refractive errors were associated with RTA (p value 0.021).[14]

2.2.3 Glaucoma

It is one of the commonest causes of blindness in the world. Glaucoma usually results in depression of the peripheral visual fields sparing the central vision. It is an irreversible condition. Drivers with glaucoma report difficulty in driving due to restricted visual fields. Studies show that glaucoma is likely to cause blindness if left untreated. Drivers with glaucoma are more likely to experience vehicle accidents.[16] McGwin in USAfound that people with glaucoma are at increased risk of car accidents as they are 1.7 times more likely to be involved in accidents than those without glaucoma.[17] Drivers with visual field loss from glaucoma are slow to anticipate and respond to changes in road conditions. They may also have more difficulty matching speed when changing lanes and keeping in their lane especially when navigating curves in the road.

2.2.4 Diabetic Retinopathy

This is a vascular complication of both type 1 and type II diabetes that poses a serious threat to vision. Diabetic retinopathy is the most frequent cause of new cases of blindness among adults aged 20 to 74 years. It exposes a serious threat to vision due to involvement of the macula (specialized for high acuity vision). Several studies have been done to determine whether there is association between diabetes and RTAs, Hansotia and Broske indicated that diabetic drivers have slightly increased risks for RTA than those not affected[18], however there are no studies that show association between diabetic retinopathy and RTA.

2.2.5 Age Related Macular Degeneration

For older drivers, this is considered as the main cause of visual impairment as reported by Wood et al in USA who established that drivers with early and intermediate AMD showed challenges in driving mainly when in a state of difficulty.[19] Drivers with AMD self-report more difficulties with driving, particularly night driving, even in the early stages of the disease. Self-reported difficulties in night driving in AMD have been linked to reductions in scotopic (rod-mediated) sensitivity.[9] Drivers with AMD also self-regulate their driving habits, through avoiding challenging driving situations (night time, unfamiliar areas, rush hour), and many older adults with AMD cease driving in the advanced stages of the condition. Studies have failed to find a link between AMD and increased road traffic accidents, drivers with intermediate levels of AMD have been found to have significantly lower crash rates than those with normal vision, which was suggested to arise from driver self-regulation. [19]

2.3 Visual function and driving

It is important for drivers to maintain good visual function to avoid road traffic accidents.[20] Public transport drivers are highly exposed to driving unlike personal vehicles drivers. Therefore, it goes without say that, public transport drivers need a better vision than other drivers as the risk of having an accident increases with distance driven.[10]

2.3.1 Visual Acuity

Studies explain that visual acuity screening is essential prior to receiving a driving license. For instance, in the USA, road signs are designed based on sight distances with the assumption that drivers have not less than 20/30 of binocular visual acuity.[21]Visually impaired drivers have been found to have difficulty seeing road signs that may be of importance to make informed decisions while driving a vehicle e.g.speed limit signs.[22]

Research regarding visual acuity and occurrence of road traffic accidents has shown no association [14] [13] [23] or weak association.[24].Burg evaluated 17500 Californian drivers and established a weak correlation between visual acuity and crash involving older drivers. However, for young and middle-aged divers there was no association found between poor VA and road accidents.[24] Study by Freeman et al. (2005)[25] established that there was no significant correlation between visual acuity and driving problems but older drivers with impaired vision are more likely to have driving problems.

2.3.2 Visual Field

Visual field testing has been used in the United States to issue driving license but it has been established that modalities of using visual fields is not uniform from one state to

another, the guidelines are not clear.[26] Haymes et al. (2007)[27] adds that it is necessary to consider uniformity of visual field measurement when it comes to comparing driver's vision and vehicle accidents. Study by Mc Gwin et al.[28] also found that there is no significant correlation between drivers with glaucoma visual field defects and increased car crash. Several studies[29] [30] [31]have however shown that visual field defects do not necessarily mean that the driver is more likely to cause a car accident than those with normal vision. Thus, experts recommend individual assessment of driving skills is more important than comprehensive prohibitions.

2.3.3 Color Vision

Drivers with protan color deficiency regardless of their severity have shown a reduction in the ability to see red traffic lights and brake lights.[32] [33] A study conducted in Ghana attempted to establish the association between visual functions e.g. visual acuity among other and occurrence of RTAs among commercial vehicle drivers, and to evaluate their knowledge of these anomalies. The study established that drivers with visual impairment had higher chances to experience RTA compared to other drivers and foundan association between protanopia and RTAs.[34]

3. JUSTIFICATION

Poor vision among drivers is a critical issue not only for the drivers themselves but other civilians who also use the road on a daily basis.[26] Experts suggest that having a good vision particularly for PSV drivers, ensures their safety as well as that of passengers and other road users. It is against this backdrop, that the WHO recommends professional vision testing among drivers of all categories that use the road to reduce deaths and injuries secondary to RTAs.

In Botswana, it has however been established that vision testing amongst the majority of the PSV drivers is not conducted by eye health professionals. This study estimated the scale of this problem through testing the vision of PSV drivers in Gaborone, Botswana. So far, this is the first study of its kind to be conducted in Botswana. The data obtained will offer much needed indigenous information on visual function amid diverse groups of public service vehicle drivers hence giving the direction of the right policy towards screening, licensure and the current rules and regulations of PSV drivers.

4.0 OBJECTIVES

4.1 Broad Objective

To assess vision of public service vehicle drivers in Gaborone, Botswana.

4.2 Specific Objectives

1. To assess visual acuity of public service vehicle drivers in Gaborone
2. To establish color vision and visual fields of public service vehicle drivers in Gaborone
3. To determine the association between inadequate visual acuity for driving and road traffic accidents occurence among PSV drivers in Gaborone

5.0 MATERIAL AND METHODS

5.1 Study Design

A cross-sectional descriptive study was adopted.

5.2 Study Setting

Figure below shows map of Botswana showing Gaborone .

The study was done in Gaborone, the capital and largest city in Botswana. According to the Botswana National Census of 2011, the estimated population of people living in Gaborone is 231,626 which is almost ten percent of the total population of the country. The City is located along the confluence of Notwane River and Segoditshane River in south-eastern part of Botswana i.e. 15 KM from the border of South Africa.

Public transportation in Gaborone is well established when compared to other major towns across Africa. The city has small buses (combis) and taxis that operate there, and other buses operate within the surrounding villages and towns across the country.

5.3 Study Population

Public service vehicle drivers registered with the Driver's Union in Gaborone, Botswana.

5.4 Inclusion Criteria

A licensed driver of a public service vehicle operating within Gaborone (intracity) and from Gaborone to other towns/villages (intercity).

5.5 Exclusion Criteria

Drivers who refused to be examined

5.6 Study Period

20th September 2019- 11th May 2021.

5.7 Sample Size

Using the sample size calculation formula for a cross-sectional study[35]

$$n=\frac{Z^2 P(1-P)}{d^2}$$

Where n is the sample size,

Z is the statistic corresponding to level of confidence (1.96),

P* is expected prevalence (that can be obtained from similar studies or a pilot study done by the researchers)

d is precision (corresponding to effect size) 13/2= (0.065).

* Proportion of drivers with inadequate visual acuity from previous studies (13%).[13]

$$n=\frac{Z^2 P(1-P)}{d^2}$$

$$n=\frac{1.96^2 x\, 0.13(1-0.13)}{0.065^2}$$

=102

Factoring in the 20% non-response rate, sample size was calculated as **122** .

5.8 Sampling Procedure

A list of all the major routes and number of drivers registered within Gaborone City was obtained from Regional Directorate of Trade and Industry. In these selected routes, the commercial station where most drivers were found was selected, that is Gaborone bus rank/terminal.Gaborone bus terminal serves both intercity and intracity services and towards the end of termini the buses, minibuses and taxis branch off and terminate in diverse locations shown by various route numbers/names.

On average a minibus makes 2-3 round trips per day while intercity buses make 1-2

round trips depending on the distance. The intercity buses travel a distance that ranges approximately 68 kilometers to 579 kilometers. Buses, minibus and taxis start to operate from 530AM and by that time they are already on the queue for departure at the bus rank to various destinations. They depart once they are full or after 30 minutes to 1 hour on quiet days. There are roughly ten (10) intercity route destinations and approximately 20 intracity route destinations at the Gaborone bus rank. Due to the COVID-19 pandemic the ministry of Transport and Communication in Gaborone had put in place a way of decongesting the Gaborone bus rank; the public service vehicles were allowed into the bus rank for purposes of offloading and would leave the bus rank immediately and enter the bus rank 30 minutes prior to loading times, only two PSV drivers were allowed to queue per route (One loading passengers and another awaiting next trip).

In keeping with these orders, convenience sampling method was adopted. All routes (Bus, mini bus, taxis) at Gaborone bus terminal were visited and any public service vehicle driver arriving at the terminus or driver waiting for the next trip fitting the inclusion criteria was selected for the study until the sample size was met. The selected drivers were taken to Always open clinic (AO) clinic within the bus rank where consent was signed and questionnaires distributed then examination done. Participants who needed refraction or other further investigations were referred to Princess Marina Hospital which is 5 km from the bus rank.

5.8.1 Recruitment and consenting

This study was conducted at the Gaborone bus rank, which is a central bus station organized according to intercity and intracity services. Recruitment was done by the study investigator and two (2) research assistants. The research assistants were trained about the study prior to commencing the study; training involved educating the assistants on what the study entails and how to select participants. The study

investigator and research assistants visited PSV drivers in each route, informed them about the study and sought their informed consent privately. Once the consent was obtained the investigator gave the questionnaires to participants and assessed vision at Always Open clinic within the bus rank.

5.9 Data Collection Procedure

Ocular examination and a structured questionnaire were designed in a local language and distributed to each person on face-to-face interviews. Questionnaires had sectionson socio-demographic characteristics (identification number, age, sex and highest level of education,), duration of driving, periods of renewal of drivers' license, and frequencyof RTAs incurred (Appendix IV). The probes in the questionnaire were based on other studies[34 20]

The ocular examination for each eye included the following procedures- visual acuity, ocular alignment assessment, external and internal eye examinations, confrontational visual fields assessment and color vision. Visual acuity was assessed using the near vision chart at 35cm and for distance with Snellen's chart at 6 meters. Pinhole acuity was done when visual acuity was less than 6/6. Participants who required refraction were referred to Princess Marina hospital. Color vision was tested using the Ishihara plate and visual fields was assessed by confrontation method.

Hirschberg test was performed with a pen torch to assess for ocular alignment. Anterior segment examination was done by use of a slit lamp. Posterior segment examination was done with a slit lamp and 90D lens for drivers with visual acuity not improving with pinhole. Individuals with a vertical cup-to-disc ratio of 0.5 and those with

significant ocular diseases were referred to Princess marina hospital for further assessment.

5.9.1 Materials Required

1. Snellen's chart
2. Near vision chart
3. Pin hole
4. Pen torch
5. 90D volk loupe
6. Slit lamp with protective shield
7. Ishihara color plates
8. Questionnaire forms
9. Consent forms

5.10 Limitations

Visual field assessment by confrontational method was used and it is not a sensitive test for visual field assessment thefore there was a possibility of missing out on patients with 6/6 vision but with significant visual field loss from glaucoma which is notdetectable by confrontational test. Due to insufficient funds, a portable visual field

(FDT) machine could not be availed for visual field assessment.Only urban drivers participated which may not be a true reprensentation of the rural PSV drivers.

5.11 Data Management and Analysis

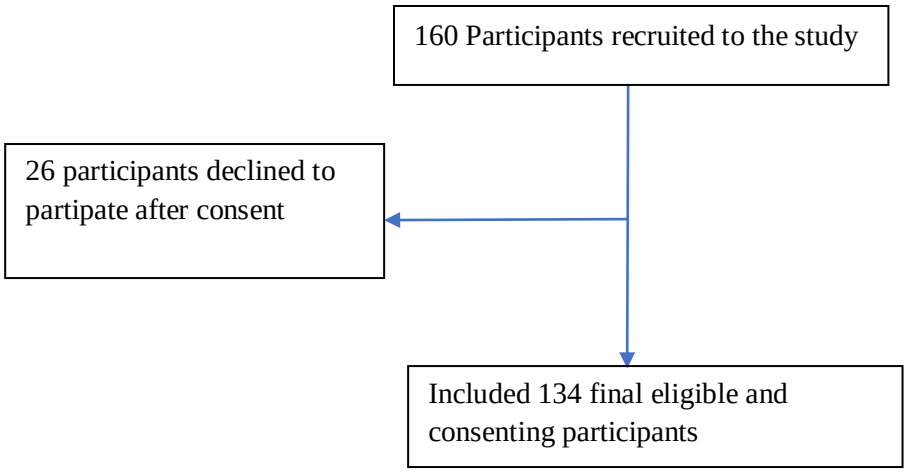
Data was coded and entered into Excel spreadsheet. Analysis was performed using SPSS version 17.0. The demographic characteristics of the population were described using age, sex and years of driving. Categorical data was summarized into proportions while continuous data was presented as means/medians. The factors associated with road accidents were analyzed using Chi-square and Fisher's test for categorical and continuous data respectively. Results were presented using graphs and tables. All statistical tests were performed at 5% level of significance (95% confidence interval).

5.12 Ethical Considerations

- Approval was sought from the University of Nairobi Ethics and Research Committee and Kenyatta National Hospital(Appendix I).
- Permission was sought from the Ministry of Health and Wellness Botswana,Health research and development division(Appendix II).
- Respondents were provided with information on the examination to be carried out and requested to fill out an informed consent sheet as a way of appreciating the aspects of autonomy(Appendix III).
- Data was concealed for the purpose of privacy of respondents once the eye examination was done.

- In regards to beneficence, respondents who were found to have eye diseases were referred for further management to Princess marina hospital after informing the hospital superintendent about the study. Drivers met their owncost of treatment at Princess marina hospital.
- Visual assessment was performed by the lead investigator in conformity to non-maleficence.
- Data was accessible to the investigator and statistician.
- The data was protected using passwords and backed up using external hard drives like flash discs.
- At the end of the study, hard copy questionnaires were destroyed via shredding.

6.0RESULTS



Study participation rate: 160/186= 86%

A total of 134 participants were interviewed in the study of which there were 133 (99.3%) male and 1 female (0.7%). Majority of them had attained secondary education (78, 58.2%) while those with no education were 13(9.7%). Most were minibus drivers

(68, 50.7%), followed by bus (34, 25.4%), and taxi (32, 23.9%). The mean age of the participants was 38.5 (SD 9.6) years and range 20-78yrs. The results are as shown on Table 1.

Table 1: Demographic characteristics of the study participants

n=134

	Number of drivers (n)	**Percentage (%)**
Gender		
Male	133	99.3
Female	1	0.7
Highest level of education		
None	13	9.7
Primary	18	13.4
Secondary	78	58.2
Tertiary	25	18.7
Age		
18-25	10	7.5
26-35	47	35.1
36-45	52	38.8
46-55	20	14.9

56-65	4	3.0
>65	1	0.7
Driver category		
Bus	34	25.4
Minibus	68	50.7
Taxi	32	23.9

Driving Experience of Participants

Majority of the participants had 6 to 10 years of driving (41, 30.6%). Two participants had less than a year of driving (1.5%). On renewal of their license, 40 (29.9%) had renewed the past 1 year, one participant had not renewed license for the past 6 years (0.7%) while 24 participants (17.9%) had not renewed their licenses. This is shown on figure 1 and 2 below.

n=134

Figure 1: Number of years of driving

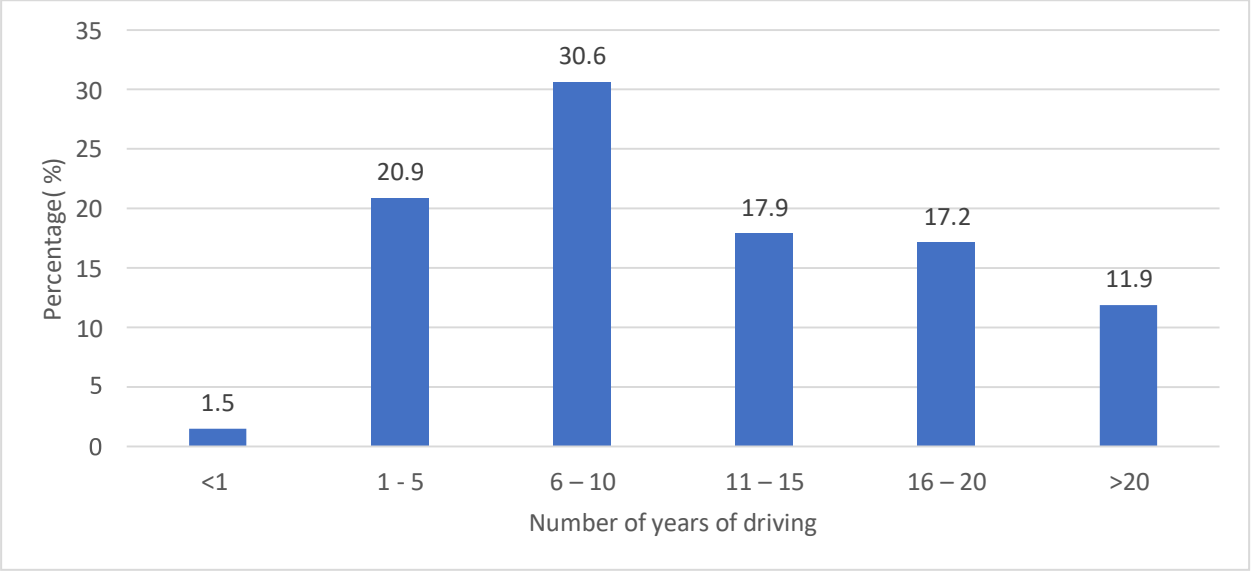


Figure 2: Last renewal of license

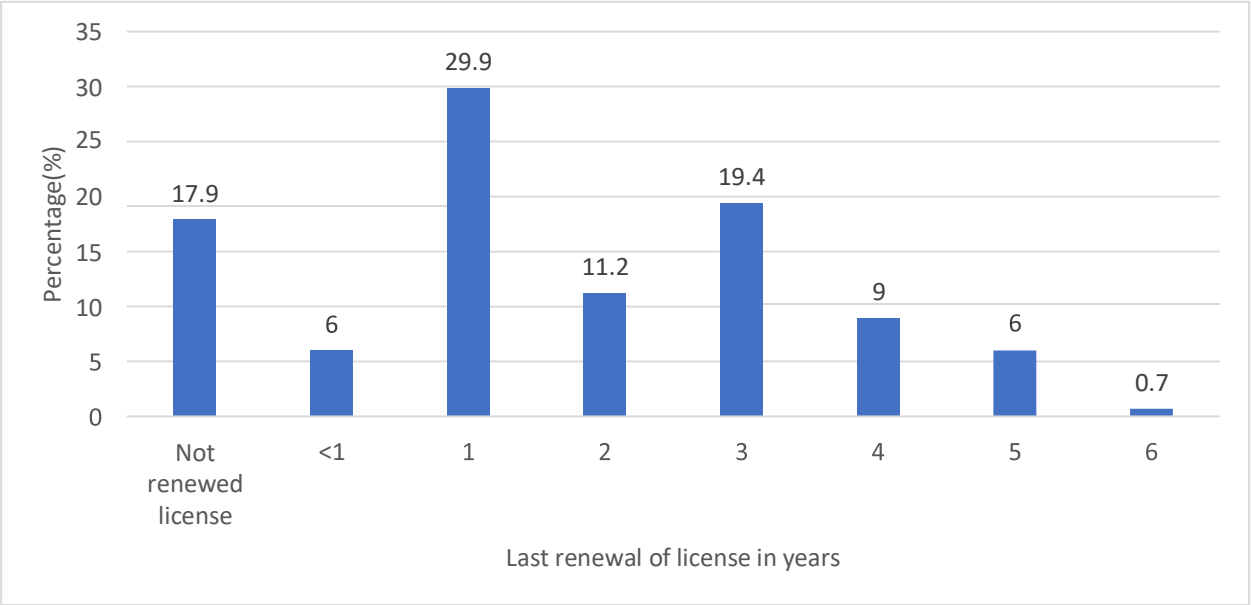
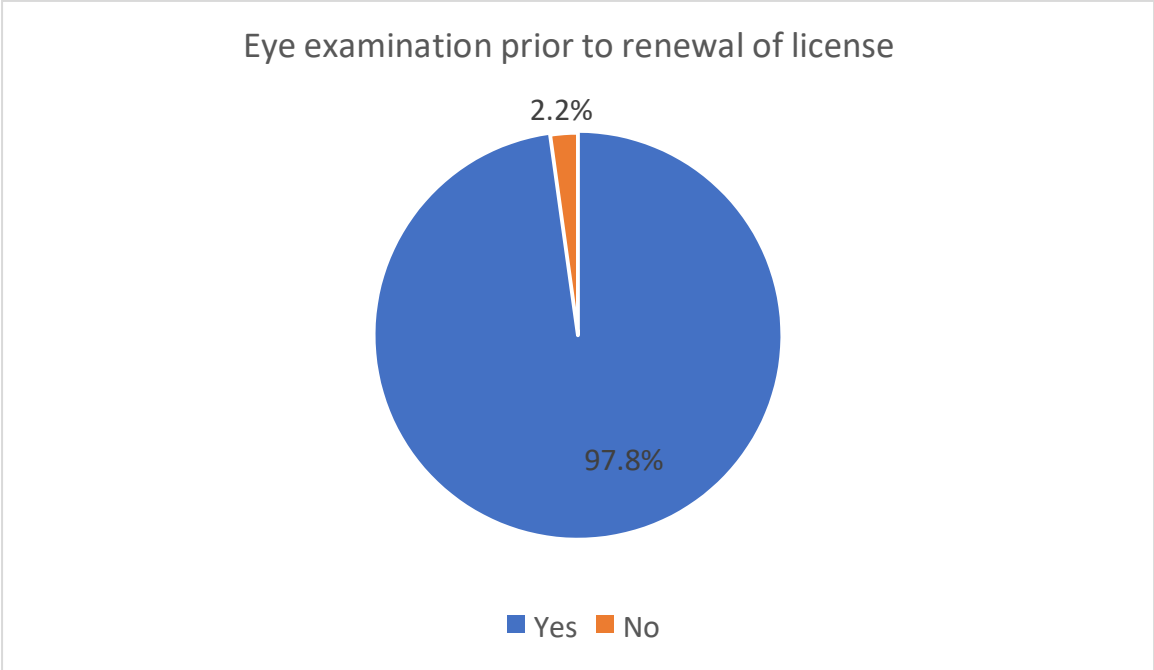


Figure 3:Eye examination prior to renewal

n=134



One hundred and thirty-one (97.8%) participants had an eye exam prior to renewal of license while 3(2.2%) participants had no eye exam prior to renewal of license.The eye examination was done by a police officer in majority of the drivers.

Table 2: Distant Visual acuity assessment amongst PSV drivers

n=134

Snellen acuity	**Right eye, *n (%)***	**Left eye, *n= (%)***	**Total, *n (%)***
6/6	92 (68.7)	91 (67.9)	183 (68.3)
6/7.5	15 (11.7)	16 (11.9)	31 (11.6)
6/9	2 (1.5)	2 (1.5)	4 (1.5)
6/9.5	8 (6.0)	8 (6.0)	16 (6.0)
6/12	6 (4.5)	7 (5.2)	13 (4.9)
6/15	3 (2.2)	2 (1.5)	5 (1.9)
6/19	2 (1.5)	2 (1.5)	4 (1.5)
6/24	5 (3.7)	4 (3.0)	9 (3.4)
6/30	1 (0.7)	1 (0.7)	2 (0.7)
2/60	-	1 (0.7)	1 (0.4)
Total	**134**	**134**	**268**

This part of the study presents result of the assessment of the visual acuity of the public service vehicle drivers. There were 92 drivers(68.3% of the total eyes) with visual acuity of 6/6 (Logmar 0.0), followed by 16 drivers(11.6 % eyes) with 6/7.5 (Logmar 0.1). One participant had monocular vision with visual acuity of 2/60 (0.4%) in the left eye.

Figure 4 : Refractive errors amongst PSV drivers

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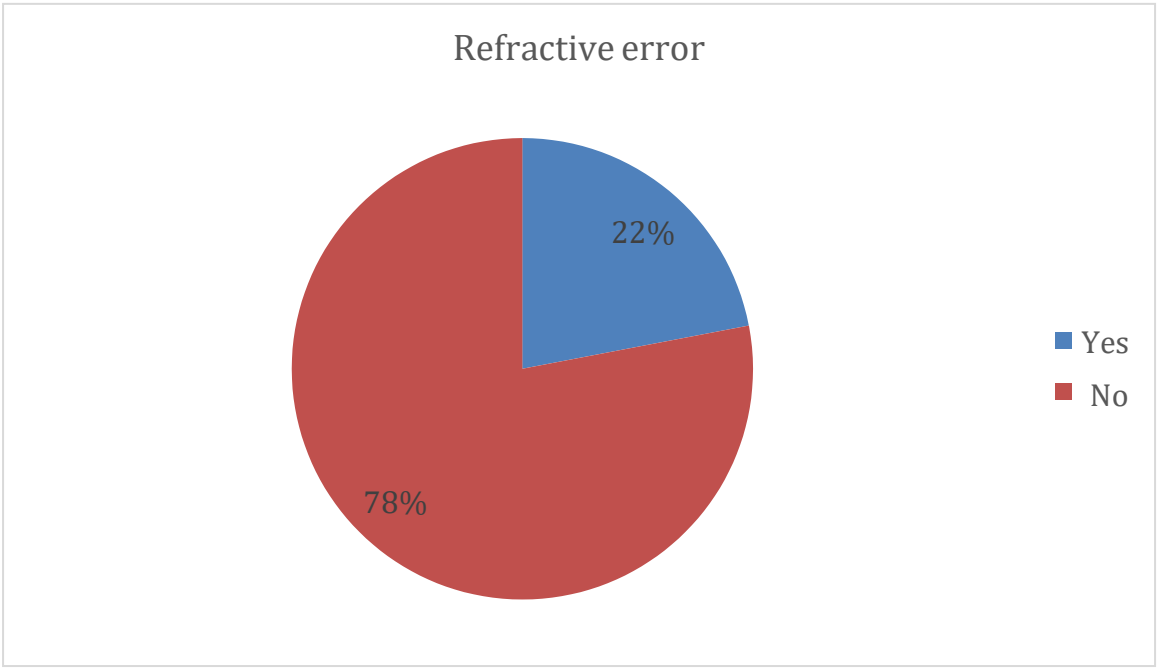


Eyes with visual acuity of less than 6/6 were assessed with a pinhole and 30 drivers(22% eyes) were found to have uncorrected refractive errors.

Table 3: Near visual acuity Assessment

n=134

Near chart	**Right eye, *n (%)***	**Left eye, *n (%)***	**Total, *n (%)***
N5	66 (49.3)	66 (49.3)	132 (49.3)
N6	31 (23.1)	30 (22.4)	61 (22.8)
N8	16 (11.9)	17 (12.7)	33 (12.3)
N10	12 (9.0)	11 (8.2)	23 (8.6)
N12	4 (3.0)	4 (3.0)	8 (3.0)
N14	2 (1.5)	2 (1.5)	4 (1.5)
N18	1 (0.7)	1 (0.7)	2 (0.7)
N24	2 (1.5)	2 (1.5)	4 (1.5)
Not assessed	-	1 (0.7)	1 (0.4)
Total	**134**	**134**	**268**

A near chart vision of N8 and worse was indicative of presbyopia. There were 37 drivers(27.6 % of total eyes) with presbyopia while one participant (0.7%) was not ableto read the near chart secondary to amblyopia.

Hirschberg test Assessment

One participant (0.7%) had left eye manifest squint.

Table 4: Slit lamp examination

n=134

Diagnosis	**RE, *n (%)***	**LE, *n (%)***
Allergic conjunctivitis	6 (4.5)	6 (4.5)
Posterior Blepharitis	1 (0.7)	1 (0.7)
Cataract +NPDR	1 (0.7)	1 (0.7)
Cataract	9 (6.7)	9 (6.7)
CDR >0.5	2 (1.5)	2 (1.5)
Macular scar	1 (0.7)	-
Normal	114 (85.1)	115 (85.8)
Total	**134**	**134**

On slit lamp examination 10 (7.4%) participants were found to have cataract, amongst these one (0.7%) had combination of cataract and mild NPDR. Two participants had a CDR of >0.5 on both eyes (1.5%).

Table 5: Visual impairment amongst PSV drivers -WHO

n=134 In the better eye

WHO Visual Standard	WHO Snellen acuity	Number of drivers, (%)
Normal	≥ 6/12	126(94.0%)
Mild VI	<6/12-6/18	5(3.7%)
Moderate VI	<6/18-6/60	3(2.2%)
Severe VI	<6/60-3/60	0
Blindness	<3/60	0

By WHO definition, most of the drivers (126, 94.0%) had good vision while 8(5.9%) had impaired vision, no driver was blind. Two thirds of the drivers (5 drivers) with visual impairment had refractive errors while a third had cataract.

Table 6: Color vision Test

n=134

Colour vision	**RE, *n (%)***	**LE, *n (%)***
Normal	132(98.5)	132(98.5)
Blue yellow deficiency	1(0.7)	1(0.7)
Red green deficiency	1 (0.7)	1 (0.7)
Total	**134**	**134**

This part of the study sought to establish the color vision and visual fields of public service vehicle drivers in Gaborone. Two participants (1.4%) had color vision defects and two had constricted visual fields (1.4%).

Table 7: Confrontational Visual Fields

n=134

Visual fields	**RE, *n (%)***	**LE, *n (%)***
Normal	132 (98.5)	132 (98.5)
Constricted	2(1.4)	2(1.4)
Total	**134**	**134**

Figure 5: PSV drivers that met visual acuity requirements

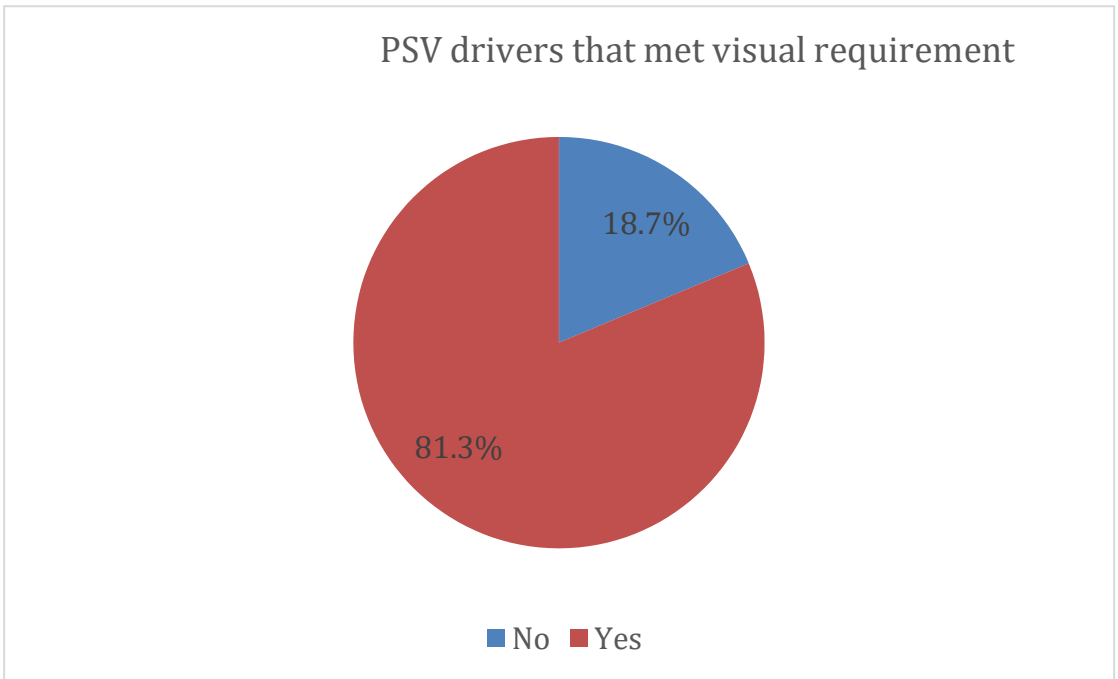
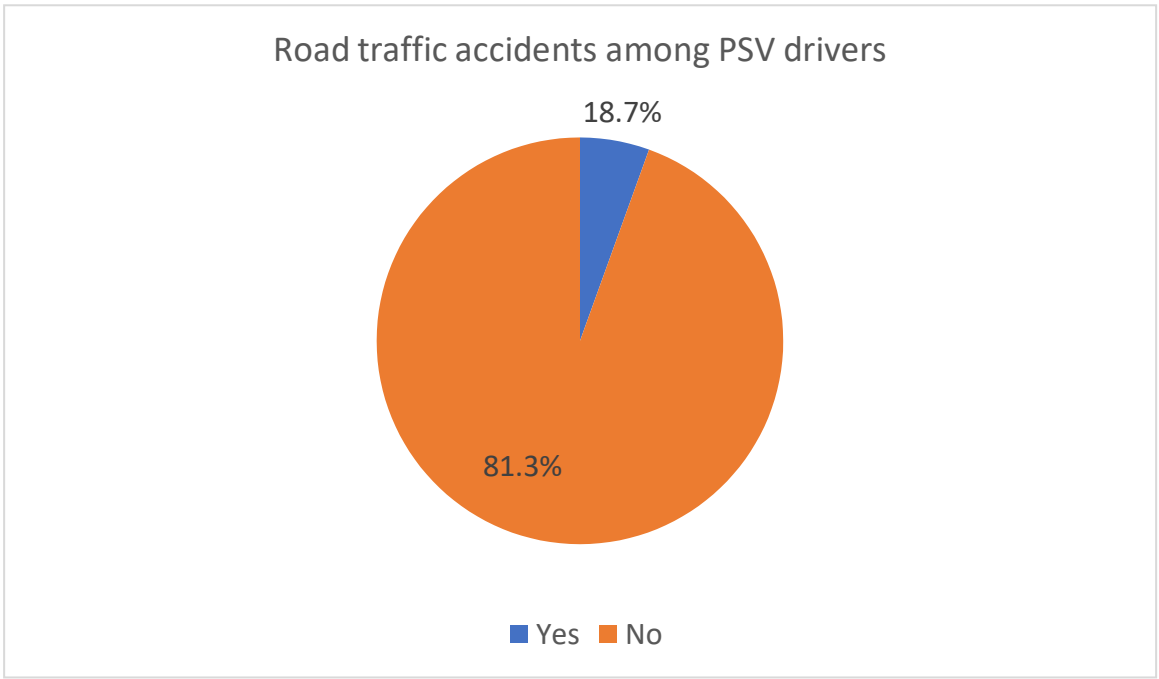


Figure above shows drivers that met visual acuity requirement for driving. It shows that majority of drivers 109 (81.3%) met the visual acuity requirement of driving a PSV in the better eye as per the law.

Figure 6: Road traffic accidents among drivers

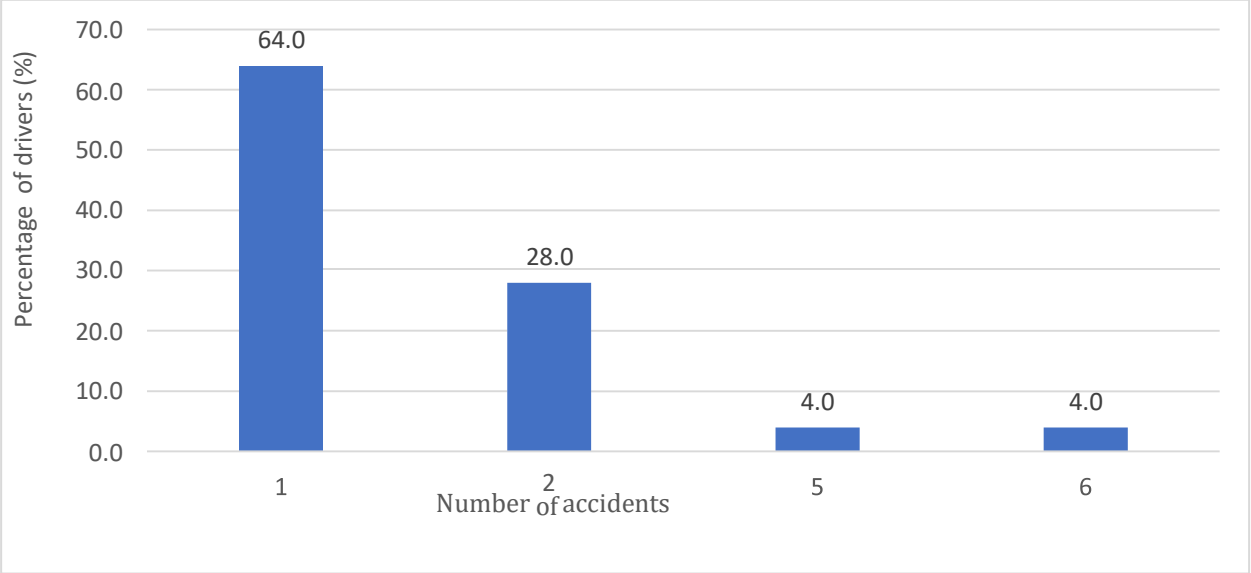
n=134



Twenty five (25) participants accounting for 18.7% reported to have been involved in road traffic accidents as shown above. All these accidents were self reported.

Figure 7: Frequency of accidents

n=25



For the 25 participants who had been involved in an RTA while driving PSV, 16 (64.0%) had been involved in 1 accident, 7 (28.0%) involved in 2 accidents, 1 (4.0%) involved in 5 accidents, and 1 driver (4.0%) who was involved in 6 accidents (Figure 7).

Causes of accidents among drivers

The major cause of accidents as mentioned by the 25 participants that were involved in an RTA were reckless driving by another driver, poor judgement and bumping into others, and bad weather which was mentioned by 5 (20.0%) participants each. There were 3 (12.0%) participants who mentioned defective brakes, and 2 (8.0%) participants each for disobedience of road signs and non-functioning traffic lights. Only 1 (4.0%) participant mentioned of animals crossing being the cause of RTA. All the drivers who were involved in accidents gave reasons for the accident occurrence (Table 8).

Table 8: Causes of accidents

n=25

Cause	Number of drivers	Percentage (%)
Reckless driving by another driver	5	20.0
Poor judgement by me	5	20.0
Bad weather	5	20.0
Bad road	3	12.0
Defective brakes	2	8.0
Non functioning traffic lights	2	8.0
Disobedience of road signs	2	8.0
Animals crossing	1	4.0
Total	**25**	**100.0**

Correlation between different factors and RTA among drivers

Table 9: Association between years of driving and RTA

Years of driving	RTA, *n (%)*	No RTA, *n (%)*	p-value
≤5	5 (20.0)	25 (22.9)	0.751
6 – 10	9 (36.0)	32 (29.4)	0.516
11 – 15	3 (12.0)	21 (19.3)	
16 – 20	5 (20.0)	18 (16.5)	
>20	3 (12.0)	13 (11.9)	
Total	**25**	**109**	

Results of the Fisher's exact test show that there were no statistical association between the different categories for years of driving and RTA.

Table 10: Association between age and RTA

Age	**RTA, *n (%)***	**No RTA, *n (%)***	**p-value**
≤35	11 (44.0)	46 (42.2)	
36 – 45	9 (36.0)	43 (39.4)	0.750
46 – 55	3 (12.0)	17 (15.6)	
>55	2 (8.0)	3 (2.8)	
Total	**25**	**109**	

Results of the Fisher's exact test show that there were no statistical association between the different age categories of the drivers and RTA. The average age of those involved with RTA was 40.1 (SD 11.8) years and those not was 38.1 (SD 9.0)

Table 11: Association between visual acuity and RTA

Results of fisher's exact test show that there was no statistical correlation betweenvisual acuity and RTA. P-value for better eye 0.377, and worse eye 0.909.

Better Eye	**RTA, *n (%)***	**No RTA, *n (%)***	**OR 95%CI)**	**p-value**
VA≥6/7.5	6 (24.0)	17 (15.6)	1.7(0.6-4.9)	0.377
VA<6/7.5	19 (76.0)	92 (84.4)		
Worse Eye				

VA≥6/7.5	6 (24.0)	25 (22.9)	1.1 (0.4-2.9)	0.909
VA<6/7.5	19 (76.0)	84 (77.1)		
Total	**25**	**109**		

Table 12: Relationship between uncorrected refractive error and RTA

Uncorrected refractive error	**RTA, *n (%)***	**No RTA, *n (%)***	**OR (95% CI)**	**p-value**
Uncorrected refractive error	8 (32.0)	24 (22.0)	1.7(0.6-4.3)	0.291
No refractive error	17 (68.0)	85 (78.0)		
Total	**25**	**109**		

There was no statistical association between uncorrected refractive error and RTA as shown below by the fisher's exact test**.** P-value 0.291

Table 13: Relationship between cataract and RTA

Cataract	**RTA, *n (%)***	**No RTA, *n (%)***	**OR (95% CI)**	**p-value**
Cataract	2 (8.0)	8 (7.3)	1.1(0.2-5.5)	0.910
No cataract	23 (92.0)	101 (92.7)		
Total	**25**	**109**		

There were two participants (8.0%) who had cataract and were involved in RTA. The fisher's exact test shows that there was no statistical association between Cataract and RTA (p-value 0.910)

Table 14: Relationship between colour vision and RTA

Colour deficiency	**RTA, *n (%)***	**No RTA, *n (%)***	**p-value**
Red green	1(0.7%)	0 (0.0)	0.339
Blue yellow	0 (0.0)	1(0.7%)	
Normal	24(17.9%)	108(80.1%)	
Total	**25**	**109**	

Two participants had colour vision deficit, and one of the participants with Red green deficit had been involved in an RTA (0.7%).

Table 15: Relationship between visual field and RTA

Visual field	**RTA, *n (%)***	**No RTA, *n (%)***	**OR (95% CI)**	**p-value**
Normal	24(17.9%)	108(80.1%)	0.2(0.01-3.7)	0.339
Constricted	1(0.7%)	1(0.7%)		
Total	**25**	**109**		

Two participants had constricted visual fields. Of these two drivers, one had been involved in a road traffic accident (0.7%) there was no statistical significance between visual field defect and RTA.

7.0 DISCUSSION

Majority of the public service vehicle drivers had good vision as per WHO visual standard while 5.9 % PSV drivers were visually impaired **Table 5**. Though it is a small

proportion it is still dangerous for road safety for public service vehicle drivers to operate

their vehicles with such visual impairment. Mwangi found lesser proportion of the drivers

to be visually impaired [13]. Almost all PSV drivers in this study were males,similar to Khalila [14] ,Mwangi [13] and Adekoya [23]. The reasons for having few females are that public

service vehicle driving is demanding and stressful and requires long hours at work. Komane in Pretoria found that rejection of female drivers in the bus driving industry by their male colleagues because of job security plays a role in the few numbers of female PSV drivers[36].Majority of PSV drivers were in the middle age group which is comparable to Mwangi[13] and Adekoya[23] and Khalila[14] .

More than three quarter drivers met the visual acuity requirements for obtaining a driver's license in Botswana as shown in **Figure 5 .** In contrast to Mwangi[13],Davison[11] and Harms[12] who found a small proportion of failure to meet visual requirements of one- tenth , the failure rate in this study was high, this can be due to the difference in the visual acuity requirements in each country; Botswana requires visual acuity of 6/7.5 in better eye[2] while Kenya[8], UK[3] and Germany require 6/9 . The regular eye examination of drivers by eye health professionals also contributes to the low failure rate in UK and Germany. The UK drivers vision assessment is done by qualified optometrists under the driver and vehicle licensing agency.[3]

This study found that about one- fifth drivers had been involved in road traffic accidents

and there was no statistical significance between the different age group categories and RTA occurrence ,this is similar to what Khalila[14] found in her study . These findings are

different from Mwangi[13] and Wood[19] who found that older drivers were involved in accidents more than younger drivers.

In terms of ocular cormobidities about a quarter participants had uncorrected refractive

errors. This is lower than in studies done by Mwangi and Khalila- they found a third to have refractive errors. Uncorrected refractive errors contributed to two- thirds of participants with visual impairment in this study. Jennings in her study in Australia found that almost all the drivers who failed to meet the visual requirement for obtaining driving license had refractive errors[11]. This finding of refractive errors could be attributed to the fact that a transport officer is the one who does vision testing for drivers and may miss this condition.

Less than a tenth drivers had cataract ,this is mainly because drivers in this study were in the middle age group. Cataract contributed to one- third of patients with visual impairment . Drivers with cataract had no statistically significant association with road traffic accident occurrence, this may be explained by Bremond study who found that drivers with cataract are more cautious hence may drive slowly than other drivers in order to keep their reaction capacities in front of road hazards, and also, they tend to avoid night driving because of high sensitivity to glare[37]. Mwangi et al, Khalila et al and Owsley found a statistical association between cataract and road accidents amongst PSV drivers. Mwangi found that drivers with cataracts were 3 times likely to be involved in accidents than those without (relative risk 3)[13], Owsley found a relative risk of 2.5[11]. This increased risk of accidents is caused by increased glare and decreased contrast sensitivity secondary to cataract[11].

There was no statistically significant association between visual acuity and RTA as shown in **Table 11** . Most studies done on motor vehicle drivers' visual acuity and occurrence of RTA have shown no association[13 14 23] or weak association[24]. Burg examined 17,500 drivers and he did not find any association between poor visual acuity and accidents

amongst the young drivers. In older drivers he found only a weak association[24]. There are

possible reasons why studies have failed to find strong association between visual acuity

and RTA – One is that drivers with poor visual acuity may avoid the road when its busy

or when visibility is poor like at night-selective driving[38]. The other reason is that drivers

with poor vision may avoid being interviewed and examined. In this study only one driver

had monocular vision,while 26 drivers refused examination probably because they knew

that they were having vision problems. According to Botswana traffic regulations[2] drivers

with monocular vision and diplopia are regarded as being unfit for a professional driving

permit.

There was no statistically significant association between refractive error and RTA. A

study in central region Ghana found similar results[34],while Khalila[14]found statistical

significance between uncorrected refractive errors and road traffic accidents.

Almost all drivers had normal colour vision and visual fileds, as shown on **Table 14** and

15 respectively. No statistically significant association was found between color

deficiency and accidents . This is comparable with studies done by Khalila[14] et al,

Mwangi[13] et al , Adekoya[23] and Vingrys[32] . Boadi-Kusi et al in Ghana found that protans

were more likely to be involved in RTA [34] . This study showed no statistical association

between visual field defect and RTA. This was comparable to Mwangi et al and Adekoya

et al who assessed visual fields by confrontational method and Khalila et al who

performed frequency doubling technology visual field assessment. This can be explained

by the fact that confrontational visual field testing may not have been sensitive enough to

detect visual field defects and that majority of participants were in middle age group.

Johnson and Kelter[39] in their study in UK using an automated perimetry found the incident of visual field loss to be 3-3.5 % for persons aged between 16-60 years.
Due to the low power of this study,the correlation between these different factors and occurrence of RTA may not have been reliable, however the correlation is clinically significant as the effect of these factors (visual acuity,refractive errors,colour vision deficiency,visual field defects) make a difference in the drivers and passengers´ lives when a road traffic accident occurs.

Other significant findings as seen on **Table 3** showed that one-third of drivers had presbyopia. Uncorrected presbyopia may disturb viewing the dashboard while driving and in-vehicle devices such as navigation (route information) and entertainment system(radio). It also affects sign recognition, lane keeping deviations and mirror checks[40]. **Table 4** shows more ocular cormobidities that were found amongst PSV drivers. Given that there were several drivers with ocular cormobidities and some of them
being significant then regular visual examination by professional medical personnel should be legislated.

8.0 CONCLUSION

Majority of PSV drivers had good vision (WHO visual standard) and met the visual requirements for driving and 30% drivers had cataract and refractive errors.Almost all drivers had normal color vision and visual fields.There was no statistically significant association found between visual acuity, refractive error, cataract, color vision and visual field defects with occurrence of road traffic accidents among PSV drivers in Gaborone.

9.0 RECOMMENDATIONS

There is need to do a larger similar study to compare association of vision and

occurrence of road traffic accidents among PSV drivers comparing them with police records of accidents as this will provide a more accurate analysis.

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11.0 APPENDICES

Appendix I : KNH -UON ERC approval letter

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Ref: KNH-ERC/A/40

5th February 2021

Dr. Unoda Lorato Fane

Reg.No. H58/19800/19

Dept. of Ophthalmology

School of Medicine
College of Health Sciences

University of Nairobi

Dear Dr. Fane
RESEARCH PROPOSAL - VISION ASSESSMENT OF PUBLIC SERVICE VEHICLE DRIVERS AT GABORONE, BOTSWANA

(P523/0912020)

This is to inform you that the KNH- I-JON Ethics & Research Committee (KNH- I-JON ERC) has reviewed and approved your above research proposal. The approval period is 5th February 2021 -4th February 2022.

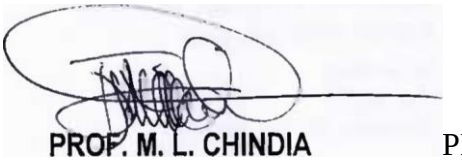
This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- I-JON ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- (JON ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (Attach a comprehensive progress repoÎt to support the renewal).
g. Submission of an executž&-sumažêll within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

For more details consult the KNH- I-JON ERC websitehttp://www.erc.uonbi.ac.ke

Yours sincerely,



PR . M. . CHINDIA
SECRETARY. KNH-U0N ERC

c.c. The Principal, College of Health Sciences, I-JON

The Senior Director, CS, KNH

The Chairperson, KNH- IJ0N ERC

The Assistant Director, Health Information Dept, KNH

The Dean, School of Medicine, I-JON

The Chair, Dept. of Ophthalmology, (JON

Supervisors: Prof. Dunera llako, Dept.of Ophthalmology, I-JON Dr. Lucy Njambi, Dept.of Ophthalmology, I-JON

Appendix II: MOHW,Health Research and Development division,Botswana approval letter

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REPUBLIC OF BOTSWANA
MINISTRY OF HEALTH AND WELLNESS

REFERENCE NO: HPDME 13/18/1 8th March 2021

Health Research and Development Division

Notification of IRB Review: New application

Dr Unoda Lorato Fane

Department of Ophthalmology

College of Health Sciences

P.O. Box 19676

University of Nairobi

Dear Dr Unoda Lorato Fane

Protocol Title: VISION ASSESSMENT OF PUBLIC SERVICE VEHICLE DRIVERS IN GABORONE, BOTSWANA (P523/09/2020)

HRU Approval Date: 08 March 2021 HRU Expiration Date: 09 March 2022
HRU Review Type: Expedited Review

HRU Review Determination: Approved Risk Determination: Minimal risk

Thank you for submitting new application for the above referenced protocol. The permission is granted to conduct the study.

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained at all times.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health and Wellness within 3 months of completion of the study. Copies should also be submitted to all other relevant authorities.

Continuing Review

In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the protocol's

Vision: A Healthy Nation hy 2036.

Values: Botho, Equìtv, Tmelliness, Customer Focus, Teamwork, Acountability expiration date, The Continuing Review Form can be obtained from the Health Research Division Office (HR-DI)), Office No. 7A.7 or Ministry of Health website: www.moh. °ov.bw or can be requested via e-mail from Mr. Kgomotso Motlhanka, e-mail address: kgmmotlhanka@gov.bw As a courtesy, the HRDD will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form

Amendments

During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment form available from the Health Research Division Office (HRDD), Office No. 7A 7 or Ministry of Health website: www.moh.gov.bw or can be requested via e- mail from Mr. Kgomotso Motlhanka, e-mail address: kgmotlhanka@gov.bw . In addition submit three copies of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

Reporting

Other events which must be reported promptly in writing to the HRDC include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subjects or others
- Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

If you have any questions please do not hesitate to contact Kgomotso Motlhanka at kgmotlhanka@gov.bw at 3632751. Thank you for your cooperation and your commitment to the protection of human subjects in research.

Yours faithfully

Dr Patrick Masokwane for/PERMANENT SECRETARY

MINISTRY OF HEALTH AND WELLNESS
RESEARCH DIVISION
0 8 MAR 2021
P/BAG 0038
GABORONE
REPUBLIC OF BOTSWANA

Vision: A Healthy Nation by 2036.
Values: Botho, Equity, TmeJliness, Customer Focus, Teamwork, Acountabilüy

Appendix III: Consent Information and Consent Form

Introduction

My name is Dr. Unoda Lorato Fane. I am a postgraduate student in the Department of Ophthalmology at the University of Nairobi. I am conducting a study on*: Vision Assessment of Public service vehicle Drivers in Gaborone, Botswana*

Purpose of the Study

1. To assess the visual acuity of public service vehicle drivers in Gaborone.
2. To assess color vision and visual fields of public service vehicle drivers in Gaborone
3. To determine the association between inadequate visual acuity for driving and occurrence of road traffic accidents among public service vehicle drivers in Gaborone

Basis of Participation

Your participation will be voluntary. You are free to withdraw at any time during the course of the study period. Your refusal to participate or withdrawal at any time during the study period will not in any way affect the quality of your treatment.

Confidentiality

All information obtained in the study will be treated with utmost confidentiality. I shall NOT use your name in any of my reports.

Benefits

The results of this study may be published in a medical book or journal or for teaching purposes and will be given to the community for better understanding of this topic.

Description of Study Procedure

The data will be obtained from two sources; an ocular examination and a structured questionnaire, which will be administered in the local language to each participant via face-to-face interviews. It will contain sections on socio-demographic characteristics (age, level of education, duration of driving, periods of renewal of drivers' license, frequency of road traffic accidents incurred. The probes in the questionnaire were based on other studies. The questionnaire will be tested and re-tested in a pilot study conducted among 10 public transport drivers who will not be part of the study. The researcher will conduct the interviews with two recruited university graduates who have previous experience in fieldwork and re-trained for the purpose of this study.

The ocular examination will include procedures such as visual acuity, external and internal eye examinations, visual field and color vision, which will be conducted by the researcher with relevant practice experience. Visual acuity will be measured for each eye with the Snellen's chart at 6m and near vision chart at 35cm. Pinhole acuity will be done when visual acuity is less than 6/6. Refraction will be conducted at referral facilities for all participants who require it. Color vision will be tested using the Ishiharaplate, while visual field assessment will be done by confrontation method.

Ocular alignment (Hirschberg test) will be assessed with a pen torch followed byanterior segment and posterior segment eye examinations which will be done with a slit lamp. Participants with a vertical cup-to-disc ratio of 0.5 and above or asymmetry of equal to or greater than 0.2 will be referred. All participants who need further examinations/evaluation will be referred to Princess marina hospital.

Risk and Discomfort

Any examination process that will be conducted by the researcher will cause no damage to the participant.

Request for Information

You may ask more questions about the study at any time or at this moment. You will be informed of any significant findings.

You may contact Dr. Unoda Lorato Fane through telephone _____ and email,_____, Department of Ophthalmology (University of Nairobi), or KNH/UoN Ethical Review Committee Secretariat P.O. Box 20723 – 00202, Nairobi, Telephone Number: +254 2726300 Ext. 44102 and email address: uonknh_erc@uonbi.ac.ke

Consent form (English)

Having read this consent form, all my questions have been answered, my signature below indicates my willingness to allow in this study and my authorization to use and share with others.

I_____after reading and having the study purpose explained to me by Dr. Unoda L.Fane, do hereby give informed consent to participate in the study.

Signed_____ Date

_____

I confirm that I have explained to the Principal the above statement.

Signature of Principal Investigator _____

Dr. Unoda Lorato Fane

Consent form (Setswana)

Ke badile mokwalo yo o kwadileng fa tebang le patlisiso ya pono mo bakgweetsing ba dikoloi tsa sechaba, dipotso tsame di arabilwe, ke baya monwana wame go supa fa ke ithaopa go tsaya karolo mo tirong e, le gore maduo aa tswang mo tirong e aka anamisiwa go ruta.

Ke le_____ke thalogantse tlhaloso le tsamaiso ya patlisiso e, le mosola wa go dira patlisiso e jaaka ngaka Unoda Lorato Fane a thalositse, ka jalo ke dumela go tsaya karolo mo go yone.

Monwana_____ Letsatsi_____

Ke thaloseditse moithaopi ka patlisiso e.

Monwana wa ngaka_____

Dr Unoda Lorato Fane

Appendix IV: Questionnaire

A. DEMOGRAPHIC DATA

1. Identification number _____
2. Sex: M___F____
3. Age in years _____
4. Highest level of education:

a. None

b. Primary

c. Secondary

d. Tertiary/College

e. Other (please specify) _____

B. OCCUPATIONAL DATA

5. In which year did you start driving? _____

6. When was the last time you renewed your drivers' license? _____

7. Did you go through an eye examination prior to the renewal of the license?

a. Yes

b. No

8. Have you ever been involved in any road accident while driving your commercial vehicle before?

a. Yes

b. No

9.How many accidents have you had in the past year?_____

10.What was the cause of the accident? _____

C. EYE EXAMINATION

	RIGHT EYE	LEFT EYE
Visual Acuity Far Near		
Pinhole		
Hirschberg test		
Eyelids		
Conjunctiva		
Cornea		
Anterior Chamber		
Pupil		
Lens		
Fundus		
Disc assessment		
Macula		
Peripheral Retina		
Colour Test		
Visual field		

Questionnaire (Setswana)

A. KITSO KA GA WENA

1. Nomore ya Omang _____
2. Bong: Rre___Mme____
3. O ngwaga tse kafe_____
4. Phitlhelelo kgolo ya gago ya sekolo

a) Ga ke a tsena Sekolo

b) Thuto tse di potlane

c) Thuto tse dikgolwana

d) Thuto tsa ithutelo tiro

e) Tse dingwe(tlhalosa)

B. TIRO E O E DIRANG

5.O simolotse go kgweetsa ka Ngwaga mang? _____

6.O ntshafaditse teseletso ya gago ya go kgweetsa labofelo leng? _____

7.O tlhatlhobetswe matlho pele ga o ntshafatsa teseletso ya gago ya go kgweetsa?

a.Ee

b.Nyaa

8.O kile wa nna le kotsi ya tsela o kgweetsa koloi e e rwalang sechaba?

a) Ee

b) Nyaa

9.O nnile le dikotsi tse kafe sale o kgweetsa koloi ye rwalang sechaba? _____

10.Kotsi e ene e bakwa ke eng _____

Appendix V: **WHO Classification of Vision and LogMAR Equivalent**

Snellen VA	**VA (LogMAR)**	**Category**	**Classification**
≥ 6/12	0.0 – 0.30	0	Normal
< 6/12 – 6/18	0.30 – 0.50	1	Mild VI
< 6/18 – 6/60	0.50 – 1.0	2	Moderate VI
< 6/60 – 3/60	1.0 – 1.80	3	Severe VI
< 3/60	<1.80	4	Blindness

Note: moderate and severe visual impairment constitute low vision.

VA, visual acuity; LogMAR, logarithm of the minimum angle of resolution; VI, visual impairment;

Appendix VI: Study Budget

MMed Thesis Budget **TITLE: Vision assessment of Public Service Vehicle drivers in Gaborone, Botswana** **Principal Investigator: Unoda Lorato Fane**			
Item	Quantity	Unit Cost	Total Cost
Proposal/Ethical approval and ministry of Education approval			
Proposal writing & printing	6 copies	Kshs. 10 per page	4000
Binding Proposal	6 copies	100	600
Ethics	1	2000	2000
Airtime		Kshs. 3 per minute	2000
		Subtotal	**8600**
Data Collection			
Typing and Printing of Questionnaires		60 per copy	300
Photocopy of questionnaires		18 per copy	5400
Stationary –pens, rubbers etc			2000
Flash Disc 16GB Hp	1	4500	4500
Box files for filing questionnaires	10	450 each	4500
		Subtotal	**16700**
Contracted services			
Statistician	1		50000
Research assistant	1		25000

	1		
		Subtotal	**75000**
Printing costs and binding of Final book			
Finished book printing (120 pages approximately)	8 copies- 100 pages	Kshs. 10 per page	8000
	8 copies- coloured 20 pages	Kshs. 30 per page	4800
Binding Finished book	2 copies- marking	100 per book	200
	8finalcopy(blackcover)	300	2400
		Subtotal	**15400**
TOTAL BUDGET			**115700**

Signature…**……** Date**: ……**

Appendix VII: Study Time Frame

Activities	**SEPT 2019**	**JUL 2020**	**AUG 2020**	**SEPT 2020**	**OCT 2020**	**NOV 2020**	**DEC 2020**	**JAN 2021**	**FEB 2021**	**MAR 2021**	**APR-SEPT 2021**
Proposal Development/Presentation											
ERC Approval											
Data Collection											
Data Analysis											
Report Writing											
Dissemination of Findings											