

**ASSESSMENT OF KENYAN OPHTHALMIC CLINICAL OFFICER'S KNOWLEDGE,  
SKILLS AND PRACTICE ON GLAUCOMA**

**BY**

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**DECLARATION**

I declare that this thesis is my original work and has not been presented for the award of a degree in any other university.

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## **DEDICATION**

This work is dedicated to my beloved wife Eunice and my daughter Stacey for the moral support and understanding during the entire period of this study.

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## **LIST OF ABBREVIATIONS**

<b>AC</b>	Anterior Chamber
<b>ACG</b>	Angle-Closure Glaucoma
<b>AGIS</b>	Advanced Glaucoma Intervention Study.
<b>ALT</b>	Argon Laser Trabeculoplasty
<b>BRVO</b>	Branch Retinal Vein Occlusion
<b>CCT</b>	Central Corneal Thickness
<b>CDR</b>	Cup Disc Ratio
<b>CI</b>	Confidence Interval
<b>CRVO</b>	Central Retinal Vein Occlusion
<b>DOS</b>	Division of Ophthalmic Services
<b>FDT</b>	Frequency Doubling Perimetry
<b>GOK</b>	Government of Kenya
<b>HRT</b>	Heidelberg Retina Tomography
<b>IOP</b>	Intraocular Pressure
<b>KMTC</b>	Kenya Medical Training College
<b>KNH</b>	Kenyatta National Hospital
<b>MD</b>	Mean Deviation
<b>MTRH</b>	Moi Teaching and Referral Hospital
<b>Nd: YAG</b>	Neodymium Yttrium Garnet.
<b>OCO</b>	Ophthalmic Clinical Officers

<b>OCT</b>	Optical Coherence Tomography.
<b>OHT</b>	Ocular Hypertension
<b>OR</b>	Odds Ratio
<b>P.I</b>	Peripheral Iridectomy.
<b>PACG</b>	Primary Angle Closed Glaucoma
<b>PAS</b>	Peripheral Anterior Synachiea
<b>PC</b>	Posterior Chamber
<b>PCG</b>	Primary Congenital Glaucoma
<b>PD</b>	Pattern Deviation
<b>PGH</b>	Provincial General Hospital
<b>POAG</b>	Primary Open Angle Glaucoma
<b>RNFL</b>	Retinal Nerve Fiber Layer
<b>SPSS</b>	Statistical Package for Social Sciences
<b>TET</b>	Trabeculectomy
<b>UON</b>	University of Nairobi
<b>VF</b>	Visual Fields

## **ABSTRACT**

**Background:** Glaucoma is a major contributor to blindness in the world. It is chronic optic neuropathy characterized by typical optic disc, retinal nerve fiber layer (RNFL) defects, and progressive visual field loss. The most important risk factor is raised intraocular pressure (IOPs). Though studies have focused on the causes and treatment of glaucoma, there is no data on Ophthalmic Clinical Officer's (OCO's) knowledge, skill and practice on glaucoma in Kenya. The OCOs are the primary health care providers for glaucoma patients, they are well placed to assess, provide treatment and refer glaucoma patients to the specialist ophthalmologists.

**Results:** A total of 49 OCOs were interviewed over a period of two months, the male to female ratio was 1.7:1, mean age of 41.8(68%) years, age ranged from 29-56 years with mean duration of practice of one year and maximum of 32 years. One hundred percent OCOs had good knowledge and understanding of importance of intraocular pressure measurement in making glaucoma diagnosis. However, our results found that (83.6%) of OCOs used direct ophthalmoscope for assessment of optic disc glaucomatous changes in patients. On skills, OCOs were classified as having poor skills as shown in Humphrey's visual field interpretation with thirty nine (79.6%) being unable to interpret. 61.2% of OCOs did not screen patients aged 40 years and above who attended eye clinics for glaucoma. The most common challenges reported for not screening was long queues. The study further established that the OCOs had various reasons to refer patients to another hospital including 52.6% for availability of ophthalmologists and 39.5% of OCOs for availability of equipment.

**Conclusion** This study we established that despite the good level of knowledge among the ophthalmic clinical officers on glaucoma, there exists gaps in skills in interpretation of glaucoma Humphrey visual fields. Majority of OCOs do not screen patients Aged 40 years and above for glaucoma.

## **INTRODUCTION AND L ITERATURE REVIEW**

### **1.1 Introduction**

Glaucoma can be described as a group of eye diseases characterized by progressive loss of visual field due to damage of the optic nerve fibers.<sup>1</sup> It can also be defined as an optic neuropathy characterized by optic disc changes and visual field loss.<sup>2</sup> Raised intraocular pressure (IOP) is a primary risk factor, but its absence or presence does not preclude glaucoma. Though glaucoma is not preventable, early detection and treatment can assist in avoiding serious damage to a person's vision.<sup>3</sup> Wilson et al. confirmed that the aim of glaucoma treatment is to slow the rate of field loss by reducing IOP<sup>4</sup>

Glaucoma is clinically and genetically heterogeneous and includes several different forms. Each of these forms has diverse causes and severities. It is subdivided on the basis of etiology (primary and secondary), anatomy of anterior chamber (open angle and closed angle) and age of onset (congenital, juvenile and adult).<sup>5</sup>Open-angle and angle-closure types are based on the mechanism by which aqueous outflow is impaired with respect to the anterior chamber angle configuration on gonioscopic evaluation. Aqueous is secreted by the ciliary epithelium and flows from the posterior chamber into the anterior chamber and out via the trabecular meshwork or via the uveoscleral routes. The IOP is determined by the balance between the rate of aqueous secretion and aqueous outflow. Derangements of any one of these mechanisms results in increased IOPs.<sup>6</sup>Generally, primary congenital glaucoma (PCG), primary open angle glaucoma (POAG) and primary angle closed glaucoma (PACG) are the three main types of glaucoma<sup>7</sup>

In Kenya the most likely first line eye care personnel for Glaucoma patients would be the OCOs; yet there is limited evidence in the literature about the OCOs ophthalmic clinical officer's knowledge, skills and practice on glaucoma in Kenya. Furthermore, glaucoma care presents major challenges because even when it is treated appropriately, blindness may still occur. The aim of this study was to evaluate ophthalmic clinical officer's knowledge, skills and practice on glaucoma in Kenya.

## **1.2 Literature Review**

### **1.2.1 Epidemiology**

Worldwide glaucoma is second to cataract as a leading cause of blindness. According to WHO (2002) model on blindness, glaucoma accounts for 6.7 million people being blind as a result of the disease.<sup>8</sup> Glaucoma affects more than 70 million people worldwide.<sup>9</sup> In Africa, America and Hispania it is 6-8 times more prevalent than in Caucasians, while Asians account for less than 10% of all clinical subtypes of the disease.<sup>10</sup> Among the different subtypes of glaucoma, primary open angle glaucoma (POAG) occurs most frequently and accounts for more than 50% of all cases of the disease.<sup>11</sup> Similarly, primary congenital glaucoma (PCG) is responsible for 0.01-0.04% of blind people worldwide<sup>12</sup> PCG is normally rare but it is the most frequent form of glaucoma in infants, with more than 80% of cases observed within the first year of life. It affects both eyes in 60-80% of cases, and usually more males (65%) are affected as compared to females (35%).<sup>13</sup>

In 2010, more than 4.5million individuals were blind due to glaucoma and the number is forecasted to rise to 5.9 million by 2020.<sup>14</sup> The magnitude of glaucoma in Kenya is estimated to be about 240,000 as projected using the American statistics while the crude glaucomatous blindness prevalence in all ages in Kenya is estimated at 0.06%.<sup>15</sup>

### **1.2.2 Classification of Glaucoma**

Glaucoma is classified according to the etiology (primary/secondary), anatomy of the anterior chamber (open angle/closed angle) and age of onset (juvenile/adult). Glaucoma's are classified as primary when they occur with no known etiology or as secondary where a previous injury or disease is contributory.

#### **1.2.2.3 Diagnosis of Glaucoma**

The diagnosis is based on optic disc damage and visual field defects<sup>16</sup>. Close attention is given to elevated IOP and a positive family history of the disease<sup>17</sup>. Diagnosis of glaucoma especially POAG requires a full comprehensive eye examination including patient history, visual acuity, biomicroscopy, tonometry, gonioscopy, optic nerve assessment, nerve fiber layer

#### 1.2.2.4 Treatment of Glaucoma

Glaucoma has no cure the Primary aim of treatment is to prevent functional impairment of vision. These can be achieved either medically or through surgery. Early detection and maintaining recommended treatment regimens could be major factors in reducing irreparable glaucomatous damage.<sup>18</sup> Ocular hypertensive medications include selective or nonselective  $\beta$ -blockers, prostaglandin analogs, carbonic anhydrase inhibitors and Parasympathomimetic agents, usually pilocarpine. For patients who do not respond to anti-glaucoma medications, laser trabeculoplasty and incision surgery are advanced methods that can be used for IOP control<sup>19</sup>

#### 2.0 The ophthalmic clinical officers.

Ophthalmic clinical officers are higher diploma holders from the Kenya Medical Training College (KMTC). The training takes a total of four and half years. The first three years of training entails study in general clinical medicine with a ward of a Diploma. Thereafter they train for eighteen months in ophthalmology with a ward of higher diploma. In Kenya optometry is a diploma course, in which the curriculum entails general ophthalmology, optics and refraction. However, in developed countries ophthalmic clinical officers training is relatively similar to optometrists although optometry in these countries is bachelor's degrees course for example the UK, USA, India, Germany.

**Table 1.0: Distribution of OCOs and Population Served**

Province	Population	No. of OCOs
Coast	3,128,517	13
Eastern	5,285,888	23
N. Eastern	1,713,559	3
Central	4,094,688	23
Rift valley	9,137,616	37
Western	4,133,213	9
Nyanza	5,104,184	9
Nairobi	3,079,737	32
<b>Total</b>	<b>35,677,402</b>	<b>149</b>

**Source:** Division of Ophthalmic Services- Population Census 1999.

## 2.1 Knowledge, skills and Practice of Ophthalmic Clinical Officers on Glaucoma

Knowledge possessed by OCOs was established based on their understanding of glaucoma; skills were determined by interpretation of three selected patient's Humphrey visual fields. Practice referred to the way in which OCOs demonstrated their acquired knowledge through actions i.e. screening and glaucoma management.

Considering that up to 50% of glaucoma is undiagnosed in industrialized countries, the potential for burden of properly assessing all glaucoma suspects is more challenging in the developing world.<sup>20</sup> about 50% of newly diagnosed patients found through screening have seen an ophthalmologists or an optometrist, but their disease was not diagnosed.<sup>21</sup>

A study by Bowling *et al* on assessment of outcomes of referrals of glaucoma patients' by optometrists from the community hospitals and their private clinics to hospitals with specialist consultant ophthalmologist who reviewed all the patients, found a substantial proportion of patients referred (n=2505) presumed to have glaucoma, nearly half (n=1148) (45.8%) had no evidence of glaucoma or ocular hypertension (OHT), with only 510(20.4%) patients confirmed with glaucoma.<sup>22</sup>

A study by Bell *et al* on diagnostic outcomes of new glaucoma referrals in Edinburgh, found that of the n=295 of referred patients by optometrists presumed to be glaucoma suspects, the largest diagnostic group after review by consultant was ocular hypertension (n= 113, 42%), 46% were diagnosed to be glaucoma of which 15% had normal intraocular pressure, 36% had no features of glaucoma or had ocular conditions unrelated to glaucoma.<sup>23</sup> This emphasizes the role of ophthalmoscope and perimetry in case detection as such cases would be missed if IOPs only forms basis for diagnosis,

Quigley HA *et al* study on how glaucoma patients are diagnosed among n=308 patients found that 85% were forty years and above, more than half were diagnosed with glaucoma at routine eye examination without ocular symptoms and those who had ocular symptoms, the symptoms were found not to be glaucoma related, (n= 124) patients had elevated IOP only, n=24 had a combination of IOP with disc or VF findings.<sup>24</sup> A study by Henson *et al* on community refinement of glaucoma found that after providing optometrists with agreed guidelines on glaucoma and referrals, glaucoma suspect patients were to be referred to trained community



optometrist for them to make a decision and those who had obvious glaucoma to be referred directly to Manchester Royal Hospital. When this was done the number of glaucoma suspects reduced by 40%, this is comparable to the percentage of false- positive referrals seen in other studies.<sup>25</sup>

Study by Augusto Azuro – Blanco in Scotland on assessment of accuracy of accredited glaucoma optometrists in diagnosis and treatment of glaucoma of (n=100) patients examined, those suspected of having glaucoma underwent full ophthalmic assessment which included; visual acuity, VF, corneal thickness using ultra sound pachymetry, slit lamp biomicroscopy to assess optic disc, tonometry to assess the IOP and gonioscopy.<sup>26</sup> Optometrists knowledge and accuracy on detection of glaucoma disc changes and interpretation of other parameters associated with glaucoma was substantially high, 89%, and the decision among the optometrists to initiate treatment was moderate at 83%.

Bristol shared care glaucoma study on community optometrists on knowledge and skills in detecting glaucoma from patients attending glaucoma clinics at Bristol Eye hospital and looked at three parameters; IOP measurements, clinical examination of vertical cup disc ratio, interpretation of stereoscopic fundus photos and selected visual fields.<sup>27</sup>

The visual field interpretation by optometrists was found to be the most accurately interpreted parameters, IOP measurements by optometrists was found to be less accurate with fair to moderate agreement as compared to experienced ophthalmologists. The CDR interpretation clinically after examination of patients was accurately identified by optometrists however, stereoscopic fundus photos identification of glaucoma changes was difficult with less agreement from slight to moderate, this study also shows that with knowledge of optometrists on glaucoma, care of the glaucoma patients can be shared between different levels i.e. 4,5 and 6 hospitals which will potentially reduce the overload of the eye department and make hospital resources more available for other aspects of ophthalmological care.<sup>27</sup>

Shah *et al* study in UK on practice of optometrists on patients aged 40 years and above of African racial descent on routine visit to eye glaucoma clinic found that 95%(n=100) optometrist examined optic disc for glaucoma changes, and tonometry was used to find out IOP levels. In this study, 35% did tonometry and assessed disc changes and visual field test to all patients aged

forty and above years whenever they attended the eye clinic. However, only 6% (n=6) of (n=100) optometrists did advise these patients of their increased risk of developing POAG

In our setting most glaucoma diagnosis is based on the cup disc ratio evaluation and IOP measurement as found by Nderi *et al* on their study on outcome of glaucoma surgeries at Mombasa Light House Eye Centre. The study found that 90.6% of all glaucoma diagnosis was based on these two parameters. Although glaucoma diagnosis is a package which includes other tests like VFs, gonioscopy and nerve fiber layer evaluation he found that this was not often done.<sup>28</sup> Most of the surgeries done were based on IOPs and CDR of the patients, this finding concurs with Bowman's findings in Tanzania who advocated for treatment of glaucoma based on IOP and CDR. Bowman notes that VF test may delay treatment and in most instances are not essential for intervention of glaucoma in our set up.<sup>29</sup>

CDR is crucial in determination of how much nerve fiber is lost to glaucoma. There's a direct relationship between IOP and CDR increments, an increase in vertical CDR of 0.1 corresponds to about 10% nerve fiber layer loss.<sup>30</sup> Given that the number of glaucoma specialist ophthalmologists in Kenya are few, with only 2 available forming a ratio of 1:2 million patients and based in major cities while majority of Kenyan population is rural, OCOs therefore play an integral role as they form a group of clinicians that are the first to come in contact with these patients.<sup>31</sup> With increasing prevalence of glaucoma in Kenya which is anticipated probably to outstrip the current capacity within hospital based glaucoma care, knowledge of OCOs of glaucoma will be necessary.<sup>32</sup>

## **2.2 Screening for Glaucoma**

Screening for glaucoma is a challenge given that there is no simple, precise and validated screening test available. Most screening methods fall short of the standards required with the most widely accepted methods to detect and assess glaucoma being the performance of a comprehensive eye examination for all patients who attend the clinic irrespective of complaints they present with.<sup>33</sup>

Tonometry has poor sensitivity and specificity for the detection of glaucoma, at cut-off of >21mmhg has sensitivity of 25.1 - 47.1% and specificity of 92.4 - 95.3%<sup>34</sup>, Frequency doubling

perimetry (FDT) is a rapid and relatively inexpensive test that can accurately detect established glaucoma, reported to have a sensitivity of 90 – 94% and specificity of 91-96%<sup>35</sup> respectively.

General population screening at any age is not cost effective, but selective screening of risk groups based on family history, black ethnicity, age or gender is considered worthwhile.<sup>52</sup> A survey on optometrist practices in Nottingham on methods they used for screening glaucoma, found that there was a great variation in all parameters examined. All the optometrists were found to have screened patients for glaucoma, but 50% of them were not aware of subtle glaucoma optic disc changes, 8% never measured IOPs and 19% never performed visual fields, of the patients aged 50 years and over, 73% had visited their optometrists but only 15% were screened for glaucoma.<sup>36</sup>

### **2.3 Study Rationale**

- I. With increasing prevalence of glaucoma in Kenya which can potentially outstrip the current capacity within hospital based glaucoma care, knowledge of ophthalmic clinical officers of glaucoma management will be necessary.
  
- II. No study has been done before in Kenya to assess the knowledge, skills and practice of ophthalmic clinical officers on glaucoma.
  
- III. The findings of this study will inform on areas that need to be tackled by policy and necessitate for in house courses that will promote knowledge, skills and practice on glaucoma.

## **2.4 General Objectives**

To establish Kenyan ophthalmic clinical officer's knowledge, skills and practice on glaucoma.

### **2.4.1 The specific Objectives were:**

- I. To determine the knowledge of OCOs on glaucoma.
- II. To assess the skills and practice among the OCOs of diagnosis, treatment of glaucoma.
- III. To establish the referral of glaucoma cases amongst the OCOs.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.0 Study Area**

This study was conducted in seven provincial hospitals, five mission eye hospitals, five selected sub-county hospitals, and two teaching and referral hospitals. However, the naming of hospitals has changed following the implementation of the new constitution which abolished provincial system of governance and introduced 47 County Governments.

#### **Referral Hospitals (level 6)**

- Kenyatta National Hospital (KNH)
- Moi Teaching and Referral Hospital (MTRH)

#### **Provincial Hospitals (level 5)**

- Kakamega Provincial General Hospital
- Coast Provincial General Hospital
- Nyeri Provincial General Hospital
- Garisa Provincial General Hospital
- Nakuru Provincial General Hospital.
- Nyanza Provincial General Hospital.
- Embu Provincial General Hospital.

#### **Mission Eye Hospitals.**

- Kikuyu Eye Unit
- Sabatia eye Unit
- Kwale Eye Unit
- Light House Eye Unit.
- Tenwek Mission Hospital

### Sub-county Hospitals (level 4).

- Bungoma sub-county hospital
- Kisii sub-county hospital.
- Kericho sub-county hospital.
- Thika sub-county hospital.
- Busia district hospital.

### 3.1 Study Design

Across-sectional hospital based study.

### 3.2 Study Population

The study participants included all ophthalmic clinical officers working in Kenya.

### 3.3 Sample Size

Ophthalmic Clinical Officers are estimated at 149 countrywide. The minimum sample size that was required for this study was calculated as;

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)} \longrightarrow \text{(Daniel, 1999)}$$

#### Where

$n'$  = sample size with finite population correction,

$N$  = size of the target population = 149

$Z$  = Z statistic for 95% level of confidence = 1.96

$P$  = Estimated proportion with good knowledge on glaucoma = 50% (no previous study on the same).

$d$  = margin of error = 2.5%

$$\begin{aligned} &= \frac{149 \times 1.96^2 \times 0.5 \times 0.5}{0.025^2 (149-1) + 1.96^2 \times 0.5 \times 0.5} \\ &= \mathbf{46 \text{ OCOs}} \end{aligned}$$

### 3.4 Study Period

June - July 2013.

### **3.5 Inclusion and exclusion criteria**

#### **3.5.1 Inclusion criteria**

All the ophthalmic clinical officers' practicing in government and mission eye hospitals.

#### **3.5.2 Exclusion criteria:**

Ophthalmic clinical officer's who declined to be interviewed.

### **3.6 Data collection instruments and technique**

#### **3.6.1 Questionnaire (appendix 11)**

A guided questionnaire was used; the questionnaires were administered by the researcher in person to the respondents. The questions for the study were validated once the questionnaires were prepared. The validation was aimed at assessing the ease of comprehension, relevance to their intended topics, effectiveness in providing useful information, and the degree to which the questions are interpreted and understood by the study population. Validation was conducted by a pre-testing on a representative group of OCOs in KNH eye clinic.

#### **3.7 Data Analysis**

Data collected was coded, entered and managed in a pre- designed Microsoft access database at the end of data entry, data was cleaned then analyzed using SPSS version 17.0 software. Level of knowledge on glaucoma was obtained by summarizing the various questions on knowledge and score given to determine the level of OCOs knowledge as either adequate or low. Skills were determined using various stereoscopic optic disc photos and Humphrey's visual fields and finally practice were analyzed based on various questions related to screening and management of glaucoma. The results were presented in tables and graphs and all statistical tests were performed at 5% level of significance (95% confidence intervals).

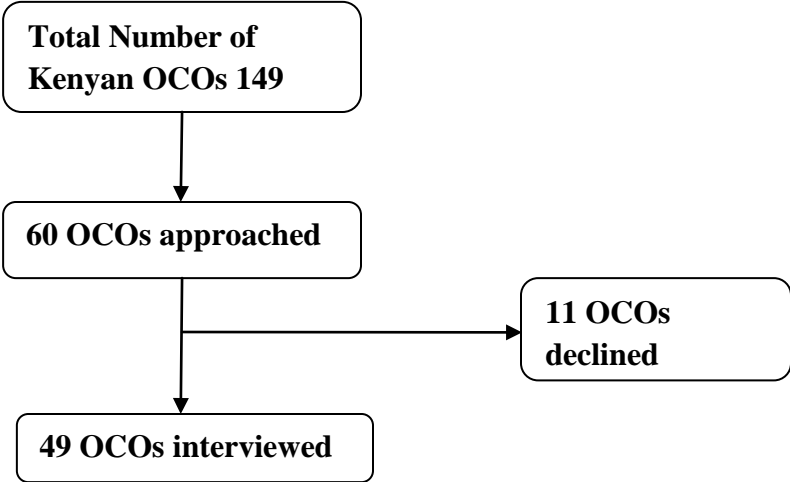
#### **3.8 Ethical Considerations (attached)**

Ethical approval was obtained from (KNH/UON) ethics and research committee and ministry of Health through the ophthalmic division.



**CHAPTER FOUR: RESULTS.**

**THE FLOW CHART**



**Figure 1.0:** A total of Kenyan OCOs are one forty nine, sixty were approached of which eleven declined, forty nine were interviewed with a response rate of 81.6%.

**Table1. 1: Social-Demographic characteristics (N=49)**

<b>Variable</b>	<b>Number (%)</b>
<b>Age(years)</b>	
Mean (SD)	41.8 (SD6.9)
Min –Max	29 – 56
<b>Gender</b>	
Male	31 (63.3)
Female	18 (36.7)
<b>Years of practice</b>	
Mean (SD)	10.3 (SD 8.4)
Median (IQR)	8 (3 – 16)
Minimum– Maximum	1 – 32

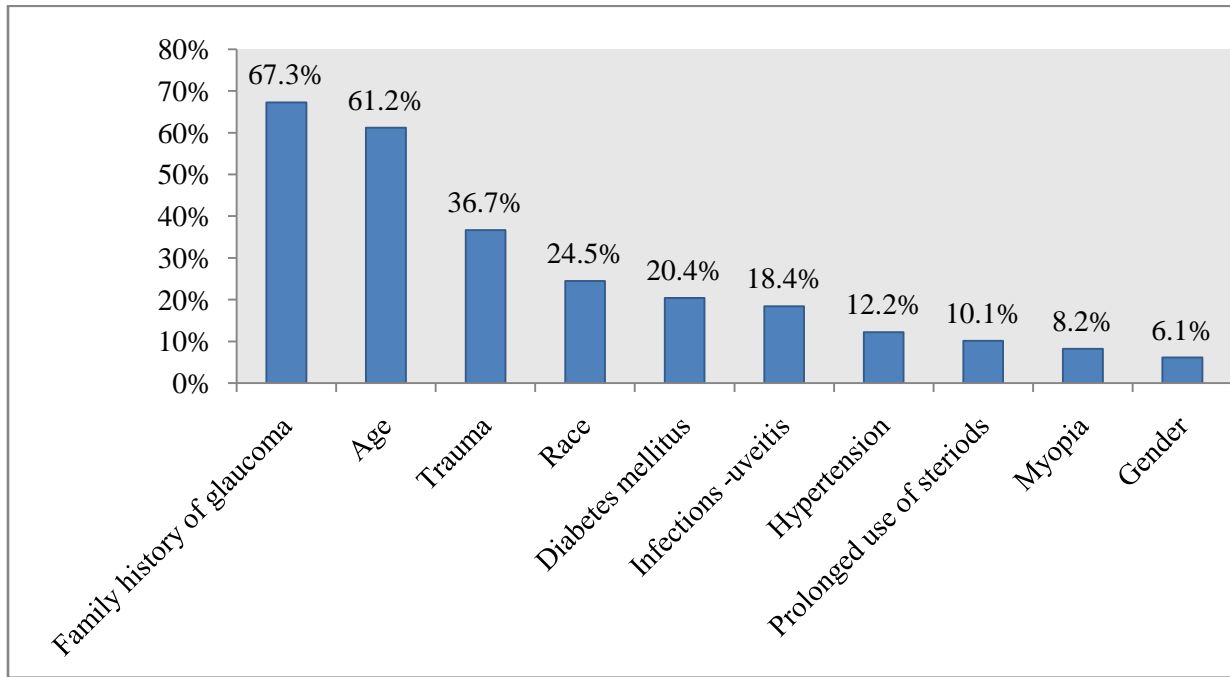
Males constituted 63.3% of the OCOs interviewed. The maximum years of practice of participants thirty two.

**Table1.2: Knowledge on definition, signs symptoms and complication of glaucoma (N=49)**

<b>Variable</b>	<b>Number (%)</b>
<b>Glaucoma definition</b>	
High intraocular pressure associated with optic nerve damage and visual loss	30(61.2)
Group of eye- disease characterized by Increase in intraocular pressure	12((24.5)
Low intraocular pressure associated with optic nerve damage.	6((12.2)
Optic nerve damage.	1(2.0)
<b>What types of glaucoma do you know?</b>	
open angle and angle closure glaucoma	48 (98.0)
Primary and Secondary glaucoma.	20 (40.8)
Congenital	30 (61.2)
Traumatic	10 (20.4)
<b>Symptoms of glaucoma</b>	
Peripheral vision loss	46 (93.6)
Pain	38 (77.6)
No symptoms	12 (24.5)
Red eye	9 (18.4)
Corneal edema	2 (4.1)
Others*	21(42.8)
<b>Complications of glaucoma</b>	
Blindness	47(95.9)
Cataracts	13(26.5)
Bullous keratopathy	6(12.2)

\*Other symptoms of glaucoma mentioned; Headache, photophobia, tearing, RAPD, Reading difficulties, seeing haloes and vomiting.

In this study, thirty (61.2%) of the forty nine OCOs correctly defined glaucoma as high intraocular associated with optic nerve damage and visual field loss.



**Figure2.0 Risk factors of glaucoma**

Majority of participants 67.3% mentioned family history of glaucoma as major risk factor for glaucoma

**Table1. 3: Knowledge on diagnosis of glaucoma.**

<b>Variable</b>	<b>Number (%)</b>
<b>How do you make a Diagnosis of glaucoma?</b>	
Intraocular pressure (IOP) and fundoscopy	37(75.5)
Visual fields assessment,IOP and fundoscopy	10(20.4)
Intraocular pressure measurement	2(4.1)
<b>Do you think IOP measurement is important?</b>	
Yes	49 (100)
To make a diagnosis of glaucoma	49 (100)
To determine which drug use	20 (40.8)
For Follow up	30 (61.2)
<b>What types of tonometers do you know?</b>	
Applanation tonometer	47 (95.9)
Schiotz tonometer	46 (93.9)
I-CARE	10 (20.4)
Tonopen	3 (6.1)
Air puff	1(2.0)
<b>Do you think Visual field assessment is important?</b>	
Yes	49 (100)
To determine the extent optic nerve damage.	40 (81.6)
To locate the area of optic nerve damage	35 (71.4)
To determine compliance to treatment	5 (10.2)
To determine progression of glaucoma	20 (40.8)
<b>What Types of perimetry do you know?</b>	
Goldman perimetry	20 (40.8)
Humphrey perimetry	17 (34.70)

Frequency doubling perimetry.	2 (4.1)
Don't know	2(4.1)
<b>How can Optic discs be assessed.</b>	
Direct ophthalmoscope	41 (83.7)
Indirect ophthalmoscope with 90D and 78D.	29 (59.2)
<b>Central corneal thickness (CCT) definition and relation with glaucoma</b>	
Don't know	49(100)
<b>How is CCT measured?</b>	
Do not know	44(89.8)
Pachymeter	5(10.2)

In this study, thirty seven (75.5%) participants made diagnosis based on IOP measurements and funduscopy for disc change. Forty nine (100%) participants indicated that the IOP measurement was important because it enabled them to make a diagnosis of glaucoma. Forty seven (95.9%) participants knew applanation tonometer. Forty nine (100%) participants don't know central corneal thickness (CCT) definition and relation with glaucoma. Forty four (89.8%) participants didn't know how CCT is measured.

**Table 1.4: Visual Field Assessment**

<b>Variable</b>	<b>Number (%)</b>
<b>Do you think Visual field assessment is important?</b>	
Yes	49 (100)
To determine the extent optic nerve damage.	40 (81.6)
To locate the area of optic nerve damage	35 (71.4)
To determine compliance to treatment	5 (10.2)
To determine progression of glaucoma	20 (40.8)
<b>What Types of perimetry do you know?</b>	
Goldman perimetry	20 (40.8)
Humphrey perimetry	17 (34.70)
Frequency doubling perimetry.	2 (4.1)
Don't know	2(4.1)
<b>How can Optic discs be assessed.</b>	
Direct ophthalmoscope	41 (83.7)
Indirect ophthalmoscope with 90D and 78D.	29 (59.2)

In this study, forty nine (100%) participants thought Visual field assessment is important with forty (81.6%) citing that they it enabled determination of the extent optic nerve damage. Twenty (40.8%) participants knew Goldman perimetry. Forty one (83.7%) participants indicated that Optic discs could be assessed through direct ophthalmoscope.

**Table 1.5: Treatment options available for glaucoma do you know (N=49)**

<b>Variable :</b>	<b>Number (%)</b>
<b>Drugs</b>	
Timolol,	47 (95.9)
Acetazolamide	42 (85.7)
latanoprost	13 (26.5)
Pilocarpine	7 (14.2)
<b>Glaucoma Laser treatment.</b>	
Argon laser trabeculoplasty	2 (4.1)
Selective laser trabeculoplasty	2 (4.1)
Don't know	47(95.9)
<b>Glaucoma Surgeries</b>	
Trabeculectomy	46 (93.9)
Peripheral iridectomy	13 (26.5)
Glaucoma drainage devices (Ahmed Valve)	4 (8.2)

Forty seven (95.9%) indicated use of timolol as the drug option for treatment of glaucoma. Forty (93.9%) participants indicated use of Trabeculectomy as the option for treatment of Glaucoma.



**Table1.6: Interpretations of stereoscopic optic disc photos (N= 49)**

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<b>Variable:</b>	<b>Number (%)</b>
Disc A: Normal disc.	
Correct response.	32 (65.3)
Incorrect response	17 (34.7)
<b>Total</b>	<b>49(100)</b>
Disc B: CDR 0.8	
Correct response.	21 (42.9)
Incorrect response.	28 (57.1)
<b>Total</b>	<b>49 (100)</b>
Disc C: Disc hemorrhage.	
Correct response.	38 (77.5)
Incorrect response.	11 (22.4)
<b>Total</b>	<b>49 (100)</b>
Do you think the Hemorrhage is related to glaucoma?	
Yes	0 (0%)
No	38 (100)
Disc D: optic atrophy	
Correct response.	34 (70.8)
Incorrect response	15 (30.6)
<b>Total</b>	<b>49 (100)</b>

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Thirty two (65.3%) participants correctly identified normal disc A with thirty eight (77.5%) for disc B. Finally, Thirty eight (77.5%) identified a disc hemorrhage in Disc C but could not relate it to glaucoma.

**Table1.7: Interpretation of visual fields (N=49)**

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<b>Variable:</b>	<b>Number (%)</b>
HVF 1: Normal field.	
Correct	5(10.2)
Incorrect	5(10.2)
No response	39(79.6)
HVF 2: ArcuateScotoma	
Correct	1(2.0)
Incorrect	9(19.3)
No response	39(79.6)
HVF 3: Tunnel vision	
Correct	4(8.1)
Incorrect	6 (12.2)
No response	39(79.6)

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Ten (20.4%) participants of the forty nine interpreted Humphreys visual fields, five (10.2%) identified normal field in HVF 1, one (2%) did not correctly identify Arcuate scotoma in HVF 2 lastly, four (8.1%) did correctly identify tunnel vision on HVF 3

**Table1.8: Screening patients for Glaucoma.**

	<b>Number (%)</b>
<b>Do you examine all patients over 40 years for glaucoma?(N=49)</b>	
Yes	19 (38.8)
No	30 (61.2)
<b>Why do you screen patients over 40 years (N=19)</b>	
Those who knew importance of screening.	9 (47.4)
Those who screened as routine eye examination.	10 (52.6)

Nineteen (38.8%) did screen patients aged 40 years and above for glaucoma. However, 61.2% did not screen for glaucoma.

**Table 1.9: Reasons for screening.**

	<b>Number (%)</b>
<b>ophthalmic clinical officers who Screen patients</b>	19 (38.8)
<b>Reasons for screening patients for glaucoma (N=19)</b>	
Age is related to development of glaucoma	4(21.0)
Asymptomatic	3(15.7)
Race common in blacks	2 (10.5)
<b>Those who Don't Screen</b>	30 (61.2)
<b>Why don't you screen patients for glaucoma (N=30)</b>	
Long queues of patients	20(66.7)
Lack of adequate personnel	5(16.7)
Examination according to patient complaints	4(13.3)
Lack of time	1(3.3)

It is noteworthy to note that nineteen (38.8%) ophthalmic clinical officers did screened patients over forty years (40 years) attending eye clinic for glaucoma. Four (21.0%) of the respondents indicated that the reasons that made them to undertake the screening was because age was related to development of glaucoma. Thirty (61.2%) participants indicated that they did not carry out the screening test with twenty (66.7%) indicating that it was because of long queues of patients.

**Table 2.0: Assessment of glaucoma patient**

<b>Assessment of glaucoma patient</b>	
<b>What do you use is assessing optic disc? (N=49)</b>	
Direct ophthalmoscope	41(83.6)
Indirect ophthalmoscope 90D or 78D	29(59.1)
Don't do fundoscopy	2(4.1)
<b>Why the preference for using direct ophthalmoscope (N=41)</b>	
It's the only one available	26 (63.4)
Easy to use	19 (46.3)
Faster	7 (17.0)
Comfortable using it	7 (17.0)
Am trained to use it	5 (12.2)
<b>What do you use in measuring IOPs (N=49)</b>	
Schiotz Tonometer	34 (67.5)
Applanation tonometer	13 (26.5)
Manual digital examination	2 (4.1)
<b>Why Schiotz preference for measuring IOPs. (N=34)</b>	
It is the only available	31 (91.2)
No dye is required	4 (11.8)
Convenient and comfortable using it	7 (20.5)
It is fast and easy to use	7 (20.5)
Accurate	6 (17.6)
I am trained to use it	6 (17.6)
<b>How do you assess patients visual fields (N=49)</b>	
Confrontational tests	39 (79.6)
Humphreys	5 (10.2)
Goldman	4 (8.2)
Humphreys and Goldman	1 (2.0)

<b>Do you do Gonioscopy to classify glaucoma (N=49)</b>	
Yes	2 (4.1)
No	47 (95.9)
<b>Reasons for not doing gonioscopy (N=47)</b>	
Goniolens is not available	32 (68.0)
Not trained	23 (48.9)

Forty one (83.6%) participants used direct ophthalmoscope in assessing optic disc, twenty six (63.4%) respondents indicated that they used direct ophthalmoscope because it was the only one available.

**Table 2.1: Treatment of patients with glaucoma (N=49).**

<b>Variable</b>	<b>Number (%)</b>
<b>Do you Counsel newly diagnosed glaucoma patients before treatment</b>	
Yes	47 (95.9)
No	2 (4.1)
<b>What are the Considerations for treatment</b>	
High IOPs(>21mmHg)	49(100)
<b>CDR &gt;0.8</b>	27(55.1)
> 0.7	12(24.4)
> 0.6	7(14.3)
> 0.5	3(6.1)
Abnormality in VF	12(24.5)
<b>Does your eye unit perform glaucoma surgeries?</b>	
Yes	14(73.6)
No	5(26.3)
<b>What do you do for patients who require surgery</b>	
Maintained on anti-glaucoma medications	10(20.4)
Referred to other centers' for surgery	7(14.3)
<b>Which types of glaucoma surgeries are performed?</b>	
Trabeculectomy	27 (55.1)
Peripheral iridectomy	2 (4.0)
Don't know	20( 40.8)
<b>Do you Perform glaucoma surgeries</b>	
Yes	7 (22.6)
No	24 (77.4)

In this study, forty seven (95.9%) participants did counsel newly diagnosed glaucoma patient's before initiation of treatment, fourteen (73.6%) hospitals of the nineteen visited performed glaucoma surgeries, ten (20.4%) participants from hospitals which did not perform surgery maintained patient's on anti-glaucoma. Finally, seven (22.6%) participants did perform glaucoma trabeculectomy surgery.

**Table 2.2: What do you use to manage your patients in your centre (N=49)**

<b>Variable:</b>	<b>Number (%)</b>
<b>Glaucoma Drugs</b>	
Timolol	47 (95.9)
Latanoprost	13(26.5)
Acetazolamide	42 (85.7)
Pilocarpine	7(14.2)
<b>Glaucoma Surgeries</b>	
Trabeculectomy	27(55.1)
<b>Glaucoma Laser treatment.</b>	
Argon laser trabeculoplasty	2(4.0)

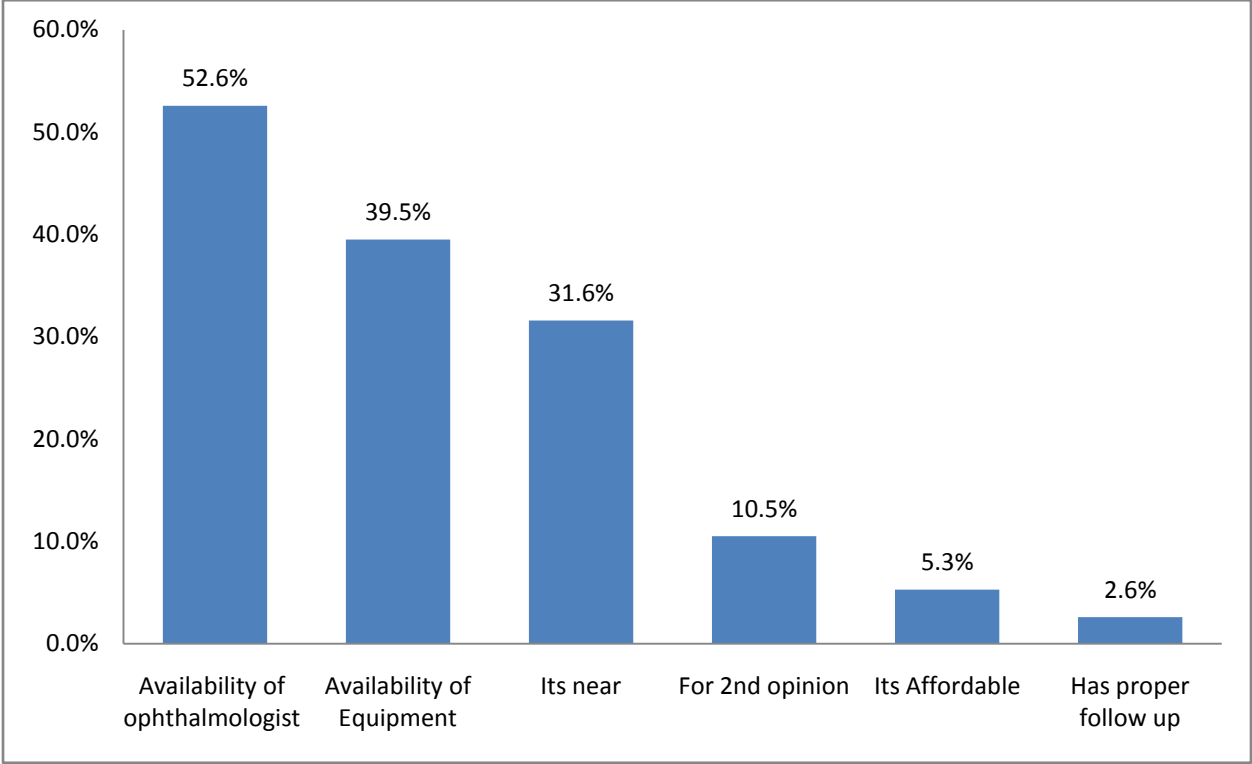
In this study, 47(95.9%) participants used timolol for management of glaucoma patients twenty seven (55.1%) used glaucoma surgery (trabeculectomy) as alternative to medical therapy.

**Table2.3: Referral of glaucoma patients (N=49).**

	<b>Number (%)</b>
<b>Do you Refer glaucoma patients.</b>	
Yes	49 (100.0)
<b>Why do you refer?</b>	
For Ophthalmologist and glaucoma specialist review	29 (64.4)
For surgical intervention	15 (33.3)
For glaucoma tests such as visual fields	3 (6.7)
Second opinion from fellow OCOs.	2 (4.4)

Twenty nine (64.4%) participants referred patients mainly for consultant ophthalmologist review and for glaucoma investigations (HVF) 15(33.3%).

**Figure3.0: Reasons for choosing to refer to a another hospital**



Majority of participants (52.6%) admitted that they referred to a particular hospital due to availability of ophthalmologist followed by those with ophthalmology equipments at 39.5%.



**Table 2.4: Association between the age, qualification and duration of practice on knowledge on glaucoma**

Variable	Knowledge		OR(95% C.I)	P-value
Age group( N=49)				
< 40	Good 24 (77.4%)	Poor 4 (22.2%)	12.0 (3.0-51.6)	<0.001
41-60	7 (22.6%)	14 (77.8%)	1.0	
Duration of practice				
< 10	19(76.0%)	6 (25.0%)	1.0	0.033
11-20	3(12.0%)	5 (20.8%)	0.2 (0.0-0.9)	
>20	3(12.0%)	13(54.2%)	0.1 (0.0-0.3)	
Qualification				
OCO/cataract surgeon	25(71.4%)	7 (50%)	2.5 (0.7-9.2)	0.155
OCO	10(28.6%)	7(50%)	1.0	

In the study, there was a statistically significant association between age, duration of practice and good level of knowledge on glaucoma.

**Table2.5: Association between qualification and duration of practice of OCOs on skills on glaucoma**

Variable	Skills		OR(95% C.I)	P-value
Duration of practice	Good	Poor		
< 10	16(57.1%)	6(28.6%)		
11-20	6(21.4%)	4 (19.0%)	0.4 (0.1-1.8)	0.256
>20	6(21.4%)	11(52.4%)	0.2 (0.1-0.8)	0.019
Qualification				
OCO/cataract surgeon	27(77.1%)	9(64.3%)	1.9 (0.5-7.2)	0.357
OCO	8(22.9%)	5(35.7%)	1.0	

In the study, there was no statistically significant association between duration of practice, age, qualification with good skills on glaucoma.

**Table2.6: Association between qualification and duration of practice of OCOs on practice on glaucoma**

Variable	Practice		OR(95% C.I)	P-value.
Duration of practice	Good	Poor		
< 10	10(35.7%)	12 (57.1%)	1.0	
11-20	10(35.7%)	3 (14.3%)	4.0 (0.9-18.6)	0.069
>20	8(28.6%)	6 (28.6%)	1.6 (0.4-6.2)	0.494
Qualification				
OCO/cataract surgeon	18 (64.3%)	17 (81.0%)	0.4 (0.1-1.6)	0.202
OCO	10 (35.7%)	4 (19.0%)	1.0	

In the study, there was no statistically significant association between duration of practice, qualification of participants with good practice on glaucoma.

**Table2.7: Suggestions on ways of improving glaucoma management.**

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	<b>Number (%)</b>
<b>How can we improve the management of patients with glaucoma by OCOs?</b>	
Regular training and refresher courses in glaucoma	35 (76.1%)
Provision of surgical equipment.	13 (28.3%)
Organizing regular glaucoma CMEs	12 (26.1%)
Supportive supervision	8 (17.4%)
Mandatory outreach screening of patients above 40 years	7 (15.2%)
Make sure the drugs are available and are affordable	6 (13.0%)
Training of more personnel	6 (13.0%)
All patients should be taken for IOP	5 (10.9%)
Screening of patients at the primary levels for early diagnosis	3 (6.5%)
Introduce patients counseling	2 (4.3%)
Introduce glaucoma clinics / Awareness of glaucoma	2 (4.3%)
Have partners to help in funding	1 (2.2%)

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In the study, thirty five (76.1%) of the forty nine mentioned regular training and refresher courses are major in improving glaucoma patient management.

### 3.9 DISCUSSION

Glaucoma in Kenya, just like in other countries in sub-Saharan Africa remains a devastating condition. It is the second leading cause of blindness worldwide, with nearly 50-90% true glaucoma patients remaining undiagnosed while nearly half of the “glaucoma patients” using ocular hypertensive medications do not need the medications or are over treated<sup>38</sup>. With these figures it is obvious that in Kenya; where there is lack of strong institutional capacity for glaucoma; care can be a big challenge. This study recruited forty nine ophthalmic clinical officers working in Kenya and sought to assess knowledge, skills and practice on glaucoma. The male to female ratio was 1.7:1, mean age 41.8 years (68%) while the range was 29-56 years.

With regard to knowledge of OCOs on glaucoma, the study findings established that thirty (61.2%) of the forty nine OCOs knew the correct definition of glaucoma as high intraocular pressure associated with optic nerve damage and visual loss. They possessed knowledge on the various types of glaucoma, Symptoms of glaucoma and complications of glaucoma. Majority of participants (67.3%) mentioned family history of glaucoma as major risk factor for glaucoma this is important as they should encourage first degree relatives to be assessed. In this study, forty seven (95.9%) of 49 OCOs knew of the ocular complications of glaucoma. This high percentage of awareness about conditions associated with or complications of glaucoma is important as it would positively motivate OCOs in an effort to detect early, treat and conduct proper follow up of patients.

On the assessment of the skills and practice among the OCOs of diagnosis, treatment of glaucoma, the study found out that 75.5% of participants diagnosed glaucoma based on IOP measurement and the CDR. This is comparable to what was found in a study at Light house eye hospital by *Nderi et al* established in his study that 90.6% of all glaucoma diagnosis was based on CDR and IOP<sup>26</sup>. OCOs had good understanding of other risk factors of glaucoma which is essential in improving vigilance of practitioners among patients at risk. The study revealed that there were poor skills among OCOs in interpretation of HVFs. This shows that there exists a gap in skills among the ophthalmic clinical officers as only 10 of 49 OCOs interpreted the VFs, with only 2% correctly identifying arcuate scotoma.

In this study, 61.2% of OCO's did not screen patients aged 40years and above who attended eye clinics. However, we also established that 52.6% of the OCOs who screened were not aware of what they were looking for. This is similar to a study by Vernon who found that even though 50% of optometrists screened patients above 40years, they were not aware of subtle optic discs signs of glaucoma.<sup>39</sup> the lack of screening awareness are probably attributed to lack of proper training. Furthermore the study established that 83.6% of participants preferred direct ophthalmoscope in examining glaucoma patients attending eye clinics, stereoscopic assessment requires use 90D/78D loupe together with slit lamp are expensive and also requires sufficient training to use them. Unavailability of these loupes may be linked to insufficient funds pumped to eye care programs and eye units in the major hospitals by the Government.

Counseling is of utmost importance in management and follow- up of any chronic illness. It has been adopted as a standard part of care in the management of glaucoma. The results found that 47(95.9%) did counsel patients before initiation of treatment. A study done in South India showed that lack of recollection of being counseled on glaucoma was an independent predictor of poor follow- up.<sup>40</sup> Applanation tonometry is considered to be gold standard in measuring IOP. It's less likely to be influenced by variables such as sclera rigidity as opposed to schiotz tonometry. In this study, 67.5% of OCOs assessed IOP using the schiotz tonometer. A study by *Drance et al* showed that schiotz tonometry missed half of glaucoma patients since they presented at a time when the IOP was not elevated and some patients might be normotensives in which the pressure will be within normal range.<sup>41</sup>

OCO's are primary eye care workers who manage patients with glaucoma or those at risk of the disease and this constitutes a major part of their workload. 10(20.4%) OCOs from these hospitals maintained patient on anti-glaucoma medications despite such patients requiring surgery with 7(14.3%) referring patients while on anti-glaucoma's to other hospitals for surgery. This study found that 100% of OCOs referred patients for varied reasons. 64.4% referred mainly for ophthalmologist review; 33.3% for surgery (trabeculectomy) while 6.7% referred for glaucoma test (visual field assessment).The study further established that the OCOs had various reasons to refer patients to another hospital. 52.6% of OCOs mainly considered availability of ophthalmologist before referring followed by 39.5% of OCOs who considered availability of

ophthalmology equipment (Humphrey or Goldman visual fields). The least reason for referring patients was existence of proper follow up.

There was a statistically significant association between age and duration of practice of OCOs with knowledge on glaucoma. Better knowledge among young OCOs could be explained by the fact that they recently graduated from school. There was no statistically significant association between the level of qualification with good knowledge, skills and practice on glaucoma. This could be explained by the fact that the only difference in training between OCO and OCO cataract surgeon is the introduction of cataract surgery but the syllabus is the same.

### **3.9.1 Conclusions**

- I. This study established that despite the good level of knowledge among the ophthalmic clinical officers, there exists gaps in skills in interpretation of glaucoma Humphrey visual fields.
- II. There was a significant relationship between good glaucoma knowledge, age and duration of practice. OCOs that had practiced for less than ten years were associated with good knowledge on glaucoma.
- III. The study established that majority of OCO's do not screen patients aged 40years and above who attended eye clinics for glaucoma and schiotz and direct ophthalmoscope were preferred in intraocular pressure measurement and fundoscopy.
- IV. The study established that all OCOs referred glaucoma patients mainly for ophthalmologist review and glaucoma visual field tests.
- V. The choice of hospital where patients were referred depended on availability of ophthalmologist and glaucoma equipment.



### **3.9.2 Limitations**

Participants gave answers cautiously because the interview was by an ophthalmologist

### **3.9.3 Recommendations**

- Continuous training of ophthalmic clinical officers on glaucoma as there exists a gap in skills among the ophthalmic clinical officers. This can be done through supportive supervision, continuous medical education at health facilities and regular skills update workshops.
- Encouraging the ophthalmic clinical officer to routinely measure IOPs and optic nerve head assessment of all patients above 40 years attending eye clinics.
- Encourage ophthalmic clinical officers to counsel glaucoma patients as this improves compliance.

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## APPENDICES

### APPENDIX I: CONSENT FORM

I am a postgraduate student at the University of Nairobi undertaking a study on knowledge, skills and practice among OCOs on glaucoma. Participation in this study is voluntary and the information gathered will be used solely for academic and intended purposes. You do not have to write your name or identify yourself in any way in the questionnaire. Thank you for your co-operation.

#### **Declaration**

I ..... Accept that I have read and understood the above explanation and I am willing to participate in the study on a voluntary basis.

Signature ..... Date .....

**APPENDIX II: QUESTIONNAIRE**

**Study to Assess Knowledge, Skills and Practice of OCOS on Glaucoma**

**Section A: Socio-Demographic Variables**

<b>Date ...../..... 2013</b>
<b>Years of practice: .....Qualifications: OCOs:.....</b>
<b>OCOs/Cataract Surgery..... Level of hospital.....</b>
<b>Any additional qualifications.....</b>

**Section B: Knowledge on Glaucoma**

1. What is glaucoma?

.....  
.....  
..

2. What types of glaucoma do you know?

.....  
.....

3. What are the risk factors associated with glaucoma?

.....  
.....  
.....

4. How does glaucoma present?

.....  
.....  
.....

5. How is the diagnosis of glaucoma made?

.....  
.....  
.....  
.....

6. Why is IOP measurement important?

.....  
.....

What different types of tonometry do you know?.....

.....  
.....

7. Why is visual field assessment important?

.....  
.....

What different types of perimetry do you know?.....

.....  
.....

8. Why is it important to assess optic discs?

.....  
.....

How can it be assessed .....

.....  
.....

9. What is central corneal thickness (CCT)?

.....  
.....

What is relationship of CCT to glaucoma.....

ii) How is it measured?.....

.....  
.....

10. What treatment options are available for glaucoma?

a)

Drugs.....

.....  
.....

b) Laser .....

c) Surgeries.....

.....  
.....

11. What are the complications of glaucoma?

.....  
.....



**Section C: Skills**

11. Can you interpret the stereoscopic optic disc photos?

**Disc A**

Yes, specify .....

No

**Disc B**

Yes, Specify .....

No

**Disc C**

Yes, Specify .....

Do you think it's a sign of glaucoma.....

No

**Disc D**

Yes, specify .....

No

12. Can you interpret the visual field shown?

**VF 1**

Yes, specify.....

No

**VF 2**

Yes, specify .....

No

**VF 3**

a) Yes, specify .....

b) No

**Section D: practice**

1. Do you examine all patients over 40 years for glaucoma?

Yes, specify.....  
.....  
.....

No

Why don't you screen.....  
.....

2. What do you routinely use to examine a patient with glaucoma/or glaucoma suspect?

a) Optic Discs, specify.....

b) IOPs specify .....

c) Do you have Perimetry?

Yes, specify.....

No

3. Do you do gonioscopy to sub classify glaucoma?

a) Yes

b) No

If yes what do you use .....

Why aren't you doing gonioscopy.....

4. Do you counsel all newly diagnosed glaucoma patients before initiating treatment?

If Yes who does the counseling.....

.....

If No why .....

.....

What are the considerations for initiation of treatment?.....

5. What medications do you use to treat glaucoma in your centre?

a) .....

b) .....

c) .....

d) .....

e) .....

6. Does your eye unit perform glaucoma surgeries?

Yes, which ones .....

No

If No what do you do to patients who require surgery.....

.....

Do you perform glaucoma surgeries?

Yes

No

7. Do you refer glaucoma patients?

Yes

No

If yes why do you refer.....

Where do you refer.....

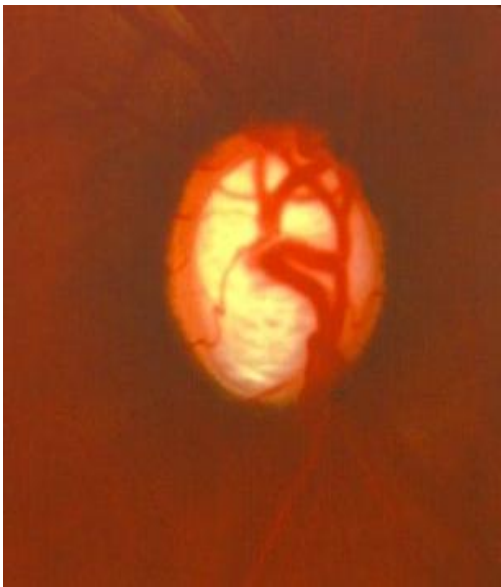
Why .....

8. How do you follow up your glaucoma patients?.....

**APPENDIX 111: STEREOSCOPIC OPTIC DISC PHOTOS**



**Normal disc -A**

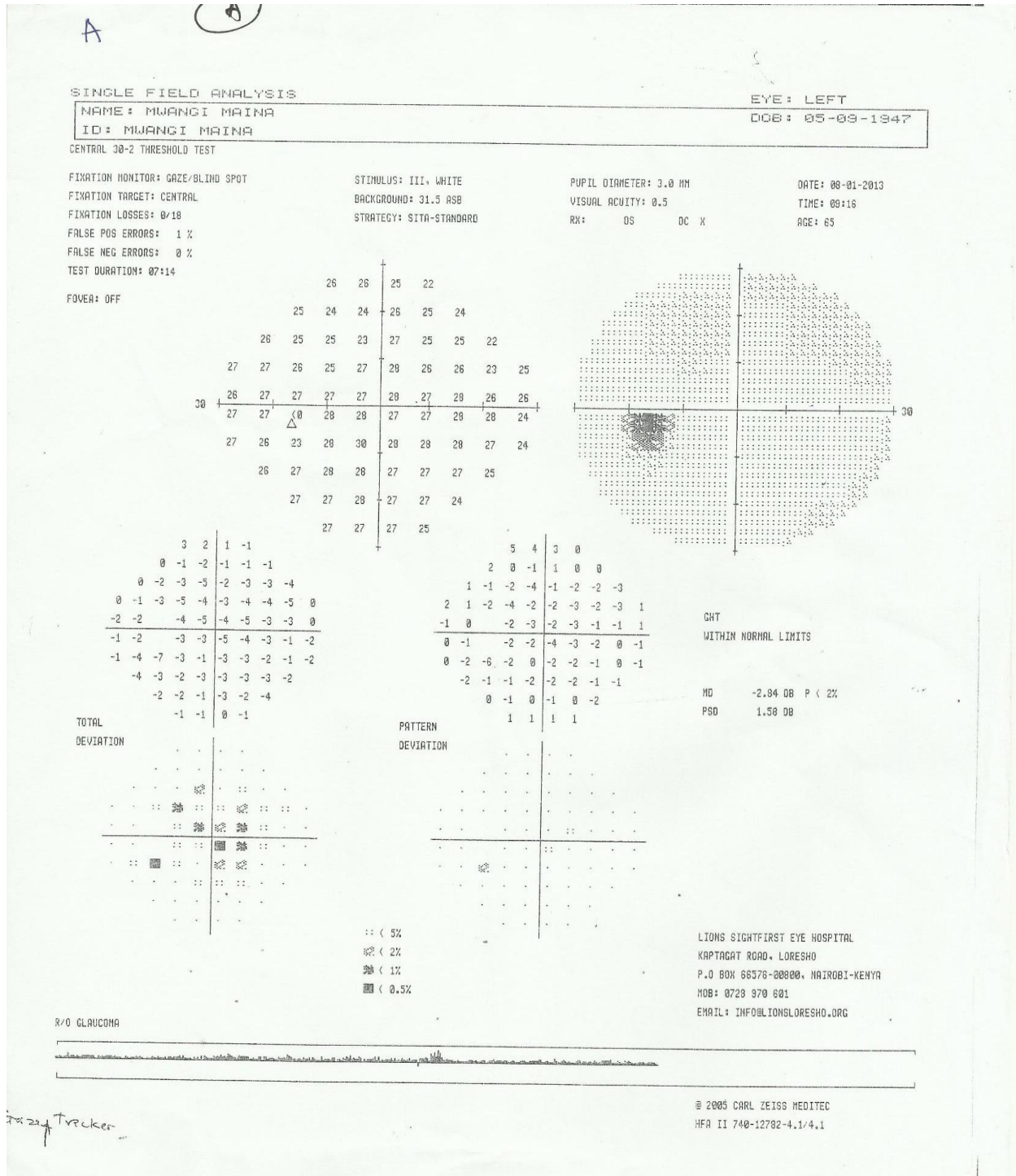


**Cup disc ratio 0.8-B**



**Optic atrophy-C**

# APPENDIX 1V: HUMPHREY VISUAL FIELDS.



**NORMAL HVF**

Single Field Analysis

Name: MICHAEL KANJA KARANJA  
ID:

Eye: Left **016**  
DOB: 28-02-1944

Central 24-2 Threshold Test

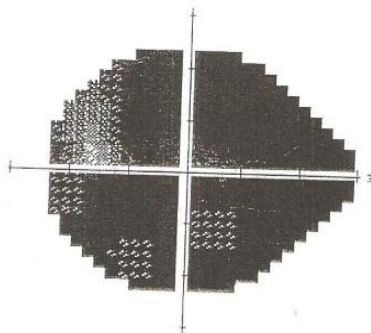
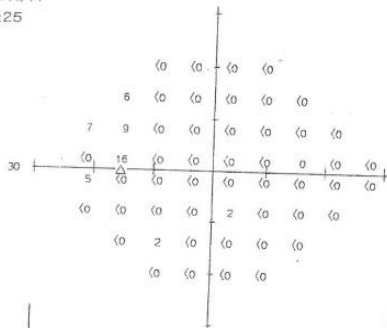
Fixation Monitor: Gaze/Blind Spot  
Fixation Target: Central  
Fixation Losses: 1/12  
False POS Errors: 0 %  
False NEG Errors: N/A  
Test Duration: 06:25

Stimulus: III, White  
Background: 31.5 ASB  
Strategy: SITA-Standard

Pupil Diameter:  
Visual Acuity: 6/30  
RX: DS DC X

Date: 17-05-2012  
Time: 11:18  
Age: 68

Fovea: OFF



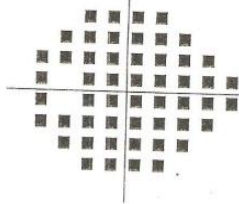
-28	-28	-28	-28
-21	-30	-31	-31
-21	-20	-32	-32
-31	-33	-33	-34
-24	-33	-34	-34
-31	-32	-33	-33
-32	-28	-33	-31
-31	-31	-31	-30

0	0	0	0
7	-2	-3	-3
-7	8	-4	-4
-3	-5	-5	-5
4	-5	-6	-6
-3	-4	-5	-5
-4	0	-5	-4
-3	-3	-3	-2

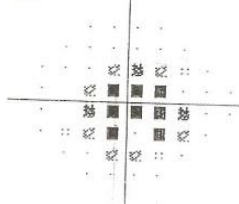
GHT  
Outside normal limits

MD -31.18 dB P < 0.5%  
PSD 3.09 dB P < 2%

Total Deviation



Pattern Deviation



∴ < 5%  
⊗ < 2%  
⊗ < 1%  
■ < 0.5%

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HFA II 740-16880-4.1/4.1

**HVF-tunnel vision**

Single Field Analysis

Name: MICHAEL KANJA KARANJA  
ID:

Eye: Right **016**  
DOB: 28-02-1944

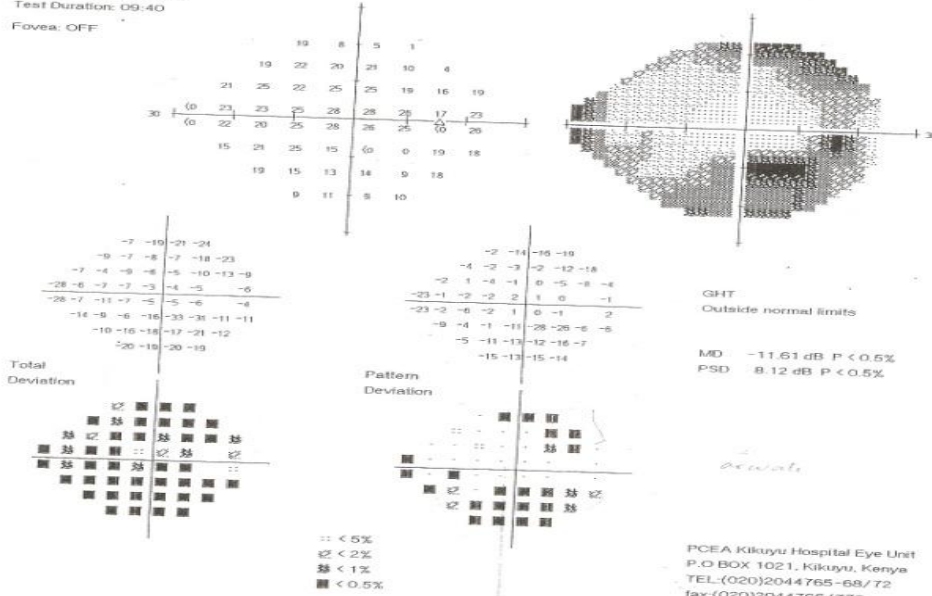
Central 24-2 Threshold Test

Fixation Monitor: Gaze/Blind Spot  
Fixation Target: Centra  
Fixation Losses: 0/19  
False POS Errors: 0 %  
False NEG Errors: 0 %  
Test Duration: 09:40  
Fovea: OFF

Stimulus: III, White  
Background: 31.5 ASB  
Strategy: SITA-Standard

Pupil Diameter:  
Visual Acuity: 6/4.5  
RX: DS DC X

Date: 17-05-2012  
Time: 10:58  
Age: 68



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**HVF -Arcuate scotoma**





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Ref: KNH-ERC/A/171

Link: [www.uonbi.ac.ke/activities/KNHUoN](http://www.uonbi.ac.ke/activities/KNHUoN)

19<sup>th</sup> June 2013

Dr. Ojuma Michael Stephen  
Dept. of Ophthalmology  
School of Medicine  
University of Nairobi.

Dear Dr. Ojuma

**RESEARCH PROPOSAL: ASSESSMENT OF OPHTHALMIC CLINICAL OFFICER'S KNOWLEDGE, SKILLS AND PRACTICE ON GLAUCOMA IN KENYA (P46/2/2013)**

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal. The approval periods are 19<sup>th</sup> June 2013 to 18<sup>th</sup> June 2014.

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 severe 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/UoN ERC within 72 hours.
- e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- g) Submission of an *executive summary* report 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.