

**DIABETIC RETINOPATHY; KNOWLEDGE,
ATTITUDES AND PRACTICE AMONG GENERAL
PRACTITIONERS IN PROVINCIAL HOSPITALS
IN KENYA**

A dissertation submitted in part fulfillment for the Degree
of Master of Medicine in Ophthalmology

University of Nairobi

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2012**



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DECLARATION

This dissertation is my original work and has not been presented for a degree at any other university.

Signed: *Rebecca*

Date: *11th October 2012*

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APPROVAL

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DEDICATION

To my husband for his love and undying support.

To my daughters Janice and Lisa for the all sacrifices and adjustments they had to make.

To my parents for their wisdom and kindness.

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LIST OF ABBREVIATIONS

AAO	American Academy of Ophthalmologists
ADA	American Diabetic Association
CSME	Clinically Significant Macular Edema
DCCT	Diabetes Control and Complications Trial
DM	Diabetes Mellitus
DR	Diabetic Retinopathy
DRS	Diabetic Retinopathy Study
DVRS	Diabetic Retinopathy Vitrectomy Study
ETDRS	Early Treatment of Diabetic Retinopathy Study
FLA	Fluoresceine Angiography
GP	General Practitioner
IDDM	Insulin dependent diabetes mellitus
IVTA	Intravitreal Triamcinolone Acetate
IQR	Interquantile range
KAP	Knowledge, Attitudes and Practice
KNH	Kenyatta National Hospital
NIDDM	Non-insulin dependent diabetes mellitus
NPDR	Non proliferative diabetic retinopathy
PDR	Proliferative diabetic retinopathy
PGH	Provincial general hospital
PRP	Panretinal photocoagulation
UKPDS	United Kingdom Prospective Diabetes Study
VEGF	Vascular Endothelial Growth

ABSTRACT

Background: Diabetes is increasingly becoming a significant problem in Kenya with more than three million people affected. Diabetic retinopathy, a complication of diabetes is among the leading causes of avoidable and preventable blindness. There are no data on awareness of diabetic retinopathy among general practitioners (GPs) in Kenya. The GPs are the primary health care providers for most diabetic patients. As such they are well placed to assess and refer diabetic patients to the eye specialists. This study aimed at evaluating the awareness of diabetes-related eye disease among GPs working at provincial hospitals in Kenya.

Design: A cross-sectional study

Objective: To assess and determine the knowledge, attitudes and practices of general practitioners working at provincial hospitals in Kenya toward diabetic retinopathy.

Methodology: The study was carried out at seven provincial general hospitals in Kenya. Participants comprised of general practitioners working at these hospitals.

The GPs were given a self administered questionnaire following which the data collected was coded, entered and managed in a pre-designed Microsoft Access database. Data analysis was carried out using SPSS version 17.0. Results were presented in tables, graphs and pie charts.

Results: Ninety one GPs were interviewed over a period of two months in the seven PGH's. The male to female ratio was 1:1 and mean age was 27.8 years (SD 4).

The level of knowledge regarding diabetes and its complications was good among the study GPs. All GPs (100%) indicated that the eyes and visual function can be impaired in DM. There were gaps noted regarding the factors influencing the presence, severity and complications of DR. Only 46.2% and 33% were aware of renal disease and pregnancy respectively as being factors that can affect presence and severity of DR. Among the GPs in the study 65.9% and 52.7% were not aware of vitreous hemorrhage and retinal detachment respectively as being complications of DR.

The practice patterns of GPs in regard to DR were generally poor with 60.5% never examining vision or only doing so when the patient complained of visual symptoms. Among these GPs 63.7% never examine the retina of their diabetic patient while 38.5% only refer DM patients to the eye specialist when they have a complaint.

Conclusions: This study establishes gaps in the knowledge on diabetic retinopathy among general practitioners working at provincial hospitals in Kenya. This included lack awareness of sight threatening complications of diabetic retinopathy such as retinal detachment and vitreous hemorrhage. It also established that the GPs had good attitude toward DR though this did not translate to good practice patterns.

1. Introduction

According to WHO up to 80% of the world's blindness is avoidable by either prevention or treatment using known cost effective means.¹

Diabetic retinopathy, a well recognized complication of diabetes accounts for 4.8% (1.8million) of the 37 million cases of blindness occurring world- wide.¹

WHO Vision 2020, a global initiative for elimination of avoidable blindness recognizes diabetic retinopathy as one of the avoidable causes of blindness.

The vision 2020 strategy seeks to eliminate avoidable blindness through cost effective disease control interventions, human resource development and infrastructure development.¹

1.1 Epidemiology of diabetes

The number of people with diabetes is increasing world-wide due to population growth, aging, urbanization and an increase in obesity.²

Global prevalence estimates of diabetes for all age groups indicate an increase from 2.8% in 2000 to 4.4% in 2030, thus the total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030.²

The greatest increase in prevalence of diabetes is predicted to occur in sub-Saharan Africa, middle- east and India.²

In Kenya, the estimated prevalence of diabetes based on regional estimates is 3.3% with up to 50% being undiagnosed. This prevalence is expected to rise to 4.6% by 2025.³

These undiagnosed cases of diabetes end up with irreversible complications in various organs such as the eyes, kidneys, feet and blood vessels.

1.2 Prevalence of Diabetic retinopathy

Diabetic retinopathy (DR) remains the greatest cause of blindness in the developed world and the developing world is fast catching up. Almost half of diabetics have some degree of DR at any given time.⁴

Diabetic retinopathy is a vascular disorder affecting the microvasculature of the retina. It progresses from mild or moderate to severe non-proliferative DR and eventually to proliferative diabetic retinopathy (PDR).⁴

Mild NPDR is characterized by increased vascular permeability. Moderate and severe NPDR are characterized by vascular closure while proliferative DR is characterized by growth of new vessels on the retina and posterior surface of the vitreous.^{4, 5}

The status of retinal microvasculature can be assessed easily by funduscopy or angiography and can be an indicator to the state of microvessels in other organs in the body.

Macular edema, characterized by retinal thickening from leaky blood vessels, can develop at all stages of retinopathy.³

Diabetic retinopathy occurs both in type 1 and type 2 diabetes mellitus, nearly all type 1 and 75% of type 2 DM will develop DR after 15 year duration of diabetes.⁴

Prevalence of DR in the Wisconsin Epidemiological Study of Diabetic Retinopathy (WESDR) was 50.1%, 54.2% in the Diabetes Control and Complications trial (DCCT) in IDDM patients and 35-39% in the United Kingdom Prospective Diabetes Study (UKPDS) in NIDDM patients.^{6, 7, 8}

In the developing countries diabetic retinopathy prevalence's of 44.3% in Mauritius, 20% in Nigeria and 47.8% in Lesotho have been reported.^{9, 10, 11} A cross-sectional hospital based study at the Kenyatta National Hospital (KNH) in 2000 by Kariuki et al found a diabetic retinopathy prevalence rate of 49.8%. Only 18% of the study patients had ever had previous eye examination¹². Among those patients with diabetic retinopathy 46.8% had blinding conditions (13.4% had CSME and 6.3% had PDR) that required treatment. These findings had a great impact in initiating of a screening program for all diabetic patients seen at the hospital.

A similar study done in rural Kenya in 2002 by Kibata et al found a DR prevalence rate of 18.3%, of these 4.9% had blinding conditions (4.6% CSME and 0.3% PDR). Among the 420 patients in the study only 20.4% had ever had their fundi examined.¹³

1.3 Risk factors for diabetic retinopathy

Duration of diabetes is a major risk factor associated with the development of diabetic retinopathy. After 5 years, approximately 25% of type 1 patients have retinopathy, 60% after 10 years, and 80% after 15 years.⁵

In the WESDR study, proliferative diabetic retinopathy, the most vision-threatening form of the disease, was present in 50% of type 1 patients with 20 years duration of the disease.⁶

Among type 2 diabetic patients in the study, those who had a known duration of diabetes of less than 5 years, 40% of those taking insulin and 24% of those not taking insulin had retinopathy. These rates increased to 84% and 53%, respectively, when the duration of diabetes increased to 19 years.⁶

Severity of hyperglycemia is a key alterable risk factor associated with the development of diabetic retinopathy. In the DCCT study participants who had either no diabetic retinopathy or early diabetic retinopathy were randomized to either intensive blood glucose control (mean HbA1C 7.2%) or conventional blood glucose control (mean HbA1C 9.1%).

The study demonstrated that intensive blood glucose control reduced the risk of progression of diabetic retinopathy by 54%, the development of severe NPDR or PDR by 47%, the need for laser surgery by 56%, and the risk of diabetic macular edema by 23%.⁷

This was also demonstrated in the UKPDS which confirmed the protective effect of intensive blood glucose control in patients with type 2 diabetes.¹⁴

Hypertension has also been shown to influence the progression of diabetic retinopathy. Intensive management of hypertension has been demonstrated to slow retinopathy progression. The UKPDS evaluated the effect of hypertension and demonstrated that patients with tight blood pressure control (<150/85 mmHg) compared to patients with less tightly controlled blood pressure (< 180/95 mmHg) were found to have a 37% risk reduction in microvascular changes, 34% risk reduction in the need for laser treatment, and 47% risk reduction in decreased vision.¹⁴

Pregnancy is occasionally associated with rapid progression of DR. Predicating factors include poor pre-pregnancy control of diabetes, too rapid control during the early stages of pregnancy and the development of preeclampsia.⁵

Other risk factors for progression of diabetic retinopathy include: obesity, particularly increased body mass, hyperlipidemia and anemia.

1.4 Treatment of diabetic retinopathy

Visual disability from diabetes is a significant public health problem. However this morbidity is largely preventable and treatable. If managed with timely intervention, vision and the quality of life can be preserved.

Several multicenter randomized controlled clinical trials have demonstrated that diabetic retinopathy can be prevented or its natural course altered.

Laser surgical treatments have been shown to minimize the complications of diabetic retinopathy. In the Diabetes Retinopathy Study (DRS), panretinal photocoagulation (PRP) was found to reduce the risk of severe vision loss (defined as vision of 5/60 or worse) in PDR from 15.9% in untreated eyes to 6.4% in treated eyes. In patients with PDR, it was observed that argon laser treatment of the retina resulted in regression of the neovascularization.¹⁵

The Early Treatment of Diabetic Retinopathy Study (ETDRS) also demonstrated that PRP can reduce the risk of severe vision loss to < 2% if administered at the appropriate stage (severe NPDR or PDR). Secondly, focal laser treatment for macular edema was found to reduce visual loss by 50%.^{16, 17}

The Diabetic Retinopathy Vitrectomy Study (DRVS) showed benefit of early vitrectomy in very severe PDR in patients with type 1 diabetes.

Two years after surgery, 36% of the early vitrectomy group and 12% of the late vitrectomy group had visual acuity of 6/12 or better.¹⁸

Intravitreal administration of short- and long-acting corticosteroids for the treatment of diabetic macular edema has also been evaluated. The Diabetic Retinopathy Clinical Research Network evaluated the role of intravitreal triamcinolone acetonide against focal laser photocoagulation. Treatment with intravitreal triamcinolone acetonide resulted in early decrease in retinal thickness at 4 months.¹⁹

These landmark studies have demonstrated that the blinding complications from diabetes can be largely prevented medically, by glycemic and blood pressure control, as well as by early detection and timely treatment of diabetic retinopathy with photocoagulation and surgical techniques.

Patients with diabetic macular edema have been found to have increased levels of VEGF in the vitreous²⁰. Thus, the potent and specific anti-VEGF drugs; bevacizumab (Avastin), an anti-VEGF antibody; and ranibizumab (Lucentis), an anti-VEGF antibody fragment are being evaluated for the treatment of diabetic macular edema.

The effectiveness of these therapies depends on appropriate and timely detection of retinopathy by health care practitioners and early referral for treatment.

1.5 Screening for diabetic retinopathy

Screening guidelines have been developed by national professional organizations such as the American Diabetes Association (ADA)⁴¹ and American Academy of Ophthalmology (AAO)²². The recommended schedule for eye examination was developed based on the landmark studies that showed that the blinding effects of diabetes can be prevented (Appendix 1).

The AAO recommends that the first fundus examination in patients with type 1 diabetes be performed 3-5 years after diagnosis. This is because retinopathy is rarely observed before this period. However, patients with type 2 diabetes should be examined immediately when they are diagnosed. This is because the duration of the disease is uncertain, so some degree of retinopathy may be present at this time. The findings at this first examination will then determine the frequency of subsequent examinations.

Screening methods for diabetic retinopathy include direct and indirect ophthalmoscopy, stereoscopic color film fundus photography, mydriatic and non-mydriatic digital color photography and monochromatic photography.²³

Although retinal imaging programs are commonly used in the developed countries and are important in improving access to care and identifying patients who need further evaluation, they do not replace comprehensive eye examination by ophthalmologists.

Traditionally, ophthalmologists have screened for diabetic retinopathy by dilating the pupil and performing indirect ophthalmoscopy, in which the entire retina is examined. This method of screening is still widely practiced in resource limited settings.

The main limitation of screening in these settings is poor or no access to an ophthalmologist, thus it is imperative that the primary care physician be aware of the potential complications of diabetes and referral protocols. They also need to be aware of the risk factors for diabetic retinopathy and the treatment options so as to adequately counsel and manage diabetic patients.

In Kenya, the ministry of health with the realization of the increasing burden of diabetes in the country put in place a national diabetes strategy in 2010. The strategy identifies training health care providers on the required competencies, provision of clinical guidelines and treatment protocols as an essential component. It seeks to establish standards of diabetes care at all levels of health care provision. Thus diabetic retinopathy a major and blinding complication of DM should be adequately addressed in the implementation of this strategy.

There are currently few and thinly spread out screening programs in Kenya. The Kenyatta national hospital has a screening program where diabetics attending the outpatient medical clinic are referred for screening at the eye clinic.

There is also a mobile outreach screening program carried out by a private facility with limited coverage mainly central and parts of western Kenya.

1.6 Knowledge, attitudes and practices (KAP) of diabetic retinopathy among general practitioners

General practitioners are important partners in the diabetic care network. A good level of awareness among general practitioners is vital in planning strategies for prevention of diabetic blindness.

Screening examinations can detect DR in its early clinical stages, yet Sinclair et al in Delaware USA found that only about half of the patients with diabetes actually received this recommended examination.²⁴

A study in Myanmar by Muecke et al found that majority of general practitioners questioned were aware that diabetes could damage the eye and impair eye sight. However, only 49% (n=100) had ever examined the fundi of their patients.²⁵

The study however did not investigate the reasons for the general practitioners inaction, but stated that the most likely factors were lack of: ophthalmoscopy equipment; familiarity with the technique of ophthalmoscopic fundus examination, familiarity with the ophthalmic signs of diabetes as well as time constraints.

A similar study in South India showed that 31.3% of GP's felt that diabetics should undergo an eye examination every six months, 53.3% felt that diabetics should undergo eye examination every year while 15.4% felt that eye examination every two years is sufficient for diabetics.

Of the GPs interviewed 54% were aware of annual dilated eye examination guidelines for diabetics, and 84% were aware of laser photocoagulation as a treatment modality for diabetic retinopathy.²⁶

Regarding practice for screening for diabetic retinopathy, only 1.3% (2) of the GPs in the study performed ophthalmoscopy. Only one of the two GPs performed dilated funduscopy while the other performed undilated funduscopy.

Barriers for carrying out diabetic retinopathy screening by general practitioners were similar to the Myanmar study. They quoted lack of time, equipment and training as barriers to screening for DR.²⁶

Similarly, Mahesh et al in Chennai India assessing KAP pattern among GP's and other health care providers toward DR found that 55% of GPs felt eye exam was not necessary at diagnosis of diabetes, 75% thought that FLA was required in all cases of DR and 60% were not aware of surgery as an option in DR treatment.²⁷

A study in Canada by Delorme et al assessing awareness on Canadian guidelines for diabetic retinopathy screening among family physicians and family medicine residents found that 13% of the family physicians and 60% of residents knew that the initial screening eye examination for DR should be done 5 years after onset of type 1 diabetes.

For type 2 diabetes, 80% of the family physicians and 92% of residents knew that the initial screening examination should be done shortly after diagnosis.²⁸

They also found that 44% of the family physicians and 58% of residents knew that diabetic women who become pregnant should be screened for diabetic retinopathy during the first trimester and closely followed throughout pregnancy. Seventy percent of GPs did not feel competent to screen for diabetic retinopathy compared with 78% of residents

A study by Khandekar et al 2003 in Oman assessing KAP toward diabetic retinopathy among primary health care physicians found that 58% of those assessed had satisfactory knowledge on the parts on the eye to be examined for DR, 40% had poor knowledge of fundus examination for DR and only 50% ever performed funduscopy. Only 5% of participants in the study believed that a physician could conduct fundus examination.²⁹

The above studies show varying results in the knowledge and attitudes with the levels being high in some studies and low in others: The practice of eye examination though was poor in most of the studies.

In Kenya there have been no studies to assess the knowledge, attitudes and practice of general practitioners toward diabetic retinopathy. General practitioners are involved in the care of diabetic patients in majority of the public health facilities across the country. Many of the health facilities lack specialized diabetologists, physicians and ophthalmologists. Thus it is imperative that the GPs be aware of diabetic retinopathy and any existing gap be addressed.

A study in Delaware USA by Gill et al assessed non-ophthalmic physician's ability to examine fundi after a 4 hour intensive training course. They found that the likelihood of failing to detect and appropriately refer patients with proliferative or pre-proliferative retinopathy decreased from 60% to 15%.³⁰

Similarly, for patients with maculopathy, the likelihood of failure to detect and to appropriately refer decreased from 83% to 15.6%.

These data suggest that training may significantly improve the ability of non-ophthalmologists to detect and to appropriately refer patients who are at risk of vision loss.

Our study sought to establish the levels of knowledge on DR among the general practitioners in Kenya who are more in contact with the diabetic patients than do the ophthalmologists.

Kenya has eight provinces each with a provincial hospital except Nairobi province. The provincial hospital is the referral point for the district hospitals. Nairobi province is home to one of the two referral/national hospitals in Kenya namely Kenyatta National Hospital. The other referral hospital is the Moi Teaching and Referral Hospital in Rift valley Kenya.

The provincial hospitals are regional centers which provide specialized care including intensive care, life support and specialist consultations. These hospitals have among other clinics specialized diabetic clinics which are run by a consultant physician working with general medical officers. Most of the provincial hospitals have one or two physicians thus the diabetics are seen by the non-specialized doctors more often.

Provincial hospitals were chosen because they are well equipped in terms of the manpower to run diabetic clinics. Most if not all have a consistent diabetic clinic and the drugs needed to treat diabetics are also available at this level.

2. STUDY RATIONALE

- Diabetics are presenting at eye clinics with advanced DR thus the need to establish any existing gap in the KAP among GP's attending to the diabetic patients.
- Data acquired will form a baseline on which intervention addressing any existing gap can be planned and evaluated.

3. STUDY OBJECTIVES

3.1 Broad objective

To determine and assess knowledge, attitudes and practices toward diabetic retinopathy among general medical practitioners working in provincial hospitals in Kenya.

3.2 Specific objectives

1. To determine the current knowledge levels on diabetic retinopathy among GP's working in provincial hospitals in Kenya.
2. To assess the attitudes among GP's towards examining diabetic patients for DR
3. To establish the current practices among the general practitioners in assessing for DR in the diabetic patients.
4. To establish the barriers to practice of screening for diabetic retinopathy.

4. STUDY METHODOLOGY

4.1 Study design

Cross – sectional descriptive study

4.2 Study participants

The study participants included all general medical practitioners working at the seven provincial hospitals in Kenya: Nakuru PGH, New Nyanza PGH, Coast PGH, Embu PGH, Nyeri PGH, Garissa PGH and Kakamega PGH.

The estimate obtained from the office of the director of medical services at the ministry of medical services put the number of medical officers and interns at about one hundred in the seven provincial hospitals. They estimated that each of these hospitals has between 10 to 12 medical officers (interns) and 4 to 6 medical officers who have completed internship.

4.3 Study setting

Kenya is a country in East Africa. The health care system has an organized referral structure so that complicated cases are referred to a higher level. The structure thus consists:

Level 1: Dispensaries and private clinics

Level 2: Health centers

Level 3: Sub-district hospitals and nursing homes

Level 4: District hospitals and private hospitals

Level 5: Provincial hospitals

Level 6: National hospitals

4.4 Study period

January - February 2012

4.5 Sample size

The estimated number of study participants was 100 medical officers as per figures obtained from the office of the director of medical services. Since the total population from which the sample was drawn was small (finite), the formula with finite population correction was used to obtain the minimum sample size. Therefore sample size was calculated as follows:

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)} \longrightarrow \boxed{(Daniel, 1999)^{34}}$$

Where

n' = sample size with finite population correction,

N = Population size = (100 estimate obtained from the office of the director of medical services)

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

P = estimated proportion of general practitioners with knowledge on diabetic retinopathy = 2%

d = margin of error = $\pm 1\%$

$$\begin{aligned} &= \frac{100 \times 1.96^2 \times 0.02 \times 0.98}{0.01^2 (100-1) + 1.96^2 \times 0.02 \times 0.98} \\ &= \mathbf{88 \text{ general practitioners}} \end{aligned}$$

4.6 Sampling method

All general practitioners who work at the provincial general hospitals including medical officer interns were requested to participate in the study.

4.7 Inclusion criteria

- All general practitioners working at the seven provincial hospitals in Kenya.
- General practitioners who gave consent to participate in the study.

4.8 Exclusion criteria

- General practitioners who refused to give consent to participate in the study.

5. MATERIALS

5.1. Questionnaire (Appendix 2)

Questions in the knowledge section were designed to test the knowledge of respondents on diabetes and diabetic retinopathy.

The questions included

- risk factors for diabetic retinopathy
- complications of diabetes
- screening and follow up of patients with diabetic retinopathy
- treatment options for diabetic retinopathy

Questions in the attitude section were designed to gauge the prevailing attitudes, beliefs and misconceptions among general medical practitioners about diabetic retinopathy. Statements were provided, and respondents asked to indicate the extent to which they agreed with the statements, on a pre-determined scale (strongly disagree, moderately disagree, neutral, moderately agree, strongly agree).

The questions covered:

- Importance of eye examination and follow up
- Importance of lipid profiling in diabetics
- Use of laser in treatment of DR
- Diagnosis of DR
- Importance of referral

Questions included in the Practice section were designed to assess the practices of the GP's with regard to diabetes and diabetic retinopathy.

The questions included:

- Examination practices as regards vision and fundi
- Advice to pregnant women with pre-existing diabetes mellitus
- Frequency of lipid profile assessment in diabetics
- Challenges that hinder eye exam in DM patients
- Referral practices

The questions for the study were validated once the questionnaire was prepared. The validation was aimed at assessing ease of comprehension, effectiveness in providing useful information, and the degree to which the questions are interpreted and understood by the study population.

Validation was conducted by pre-testing on a representative group of 10 general practitioners. Various adjustments were then made to the questionnaire.

5.2 Data collection and analysis

Data collected was coded, entered and managed in a pre-designed Microsoft Access database. Data entry was done continuously in the course of data collection. Data cleaning was performed at the end of data entry and analysis conducted using SPSS version 17.0 software.

Categorical and continuous variables that described the knowledge, attitudes and practices of the practitioners on diabetic retinopathy were summarized into proportions and means/medians respectively.

Student's t-test and Mann-Whitney U test were used to analyze differences in means and medians respectively. Chi-square test was used to test associations between categorical variables.

The findings are presented using tables and graphs. All statistical tests were performed at 5% level of significance (95% confidence interval).

5.3 Ethical considerations

The study proposal was approved by the KNH/UON Research and Ethics Committee.

The Ministry of Medical Services through the Ophthalmic Division was approached for clearance to carry out the study in the public health facilities. A letter of authorization was acquired and presented to all the hospitals where data was collected.

The study participants were requested to give an informed written consent (appendix 3) to which a detailed explanation of the study was attached (appendix 4).

Confidentiality of the data was maintained at all levels of data management.

The questionnaires did not have any identifiers of the hospital or the interviewees.

6. RESULTS

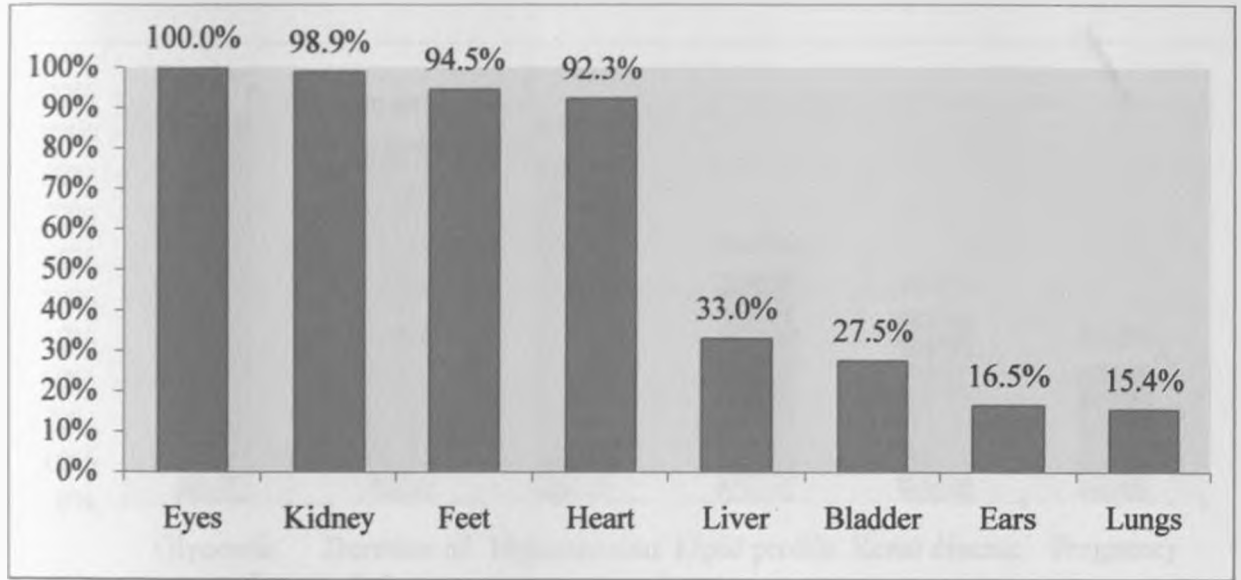
Ninety one medical officers and medical officer interns were recruited into the study. One hundred questionnaires were distributed to the 7 provincial hospitals, 91 doctors gave informed consent and participated in the study. The other 9 questionnaires were either misplaced or the individuals who were given did not hand them back to the researcher.

Table 1: Demographic characteristics

Variable	Frequency (%) (n=91)
Sex	
Male	41 (45.1)
Female	41 (45.1)
Missing	9 (9.9)
Age in years	
Mean (SD)	27.8 (4.0)
Min-Max	22.0-48.0
Currently working in general practice	
Yes	88 (96.7)
No	3 (3.3)
Median length of practice in years	1.0 (1.0-2.0)

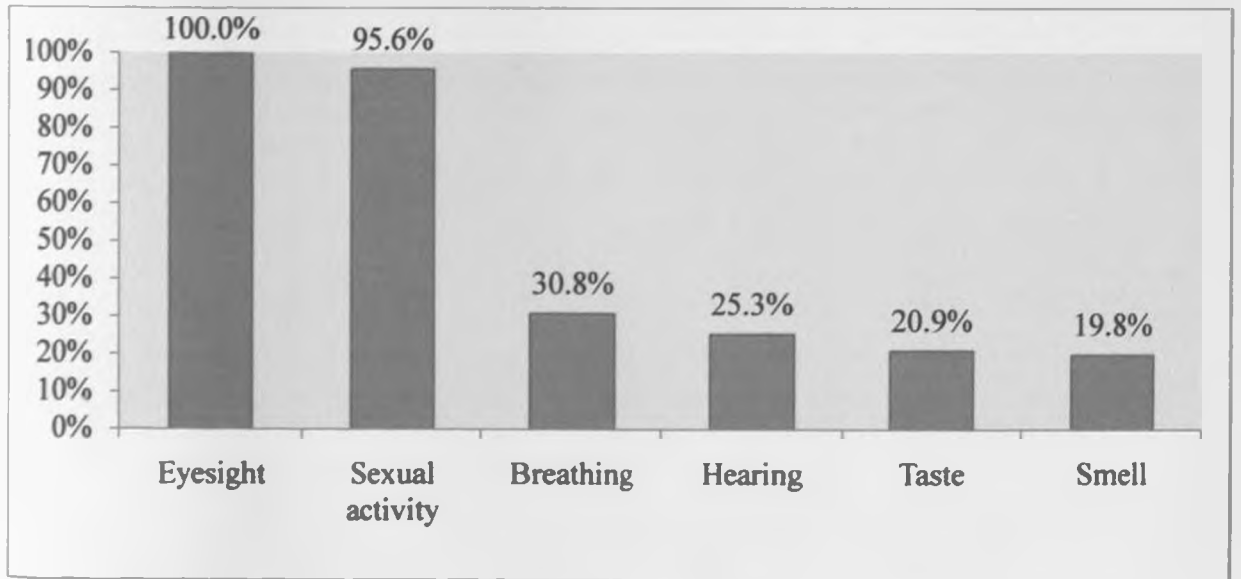
The mean age of the study participants was 27.8 years (SD 4).

Figure 1: knowledge on organs damaged by diabetes mellitus (n=91)



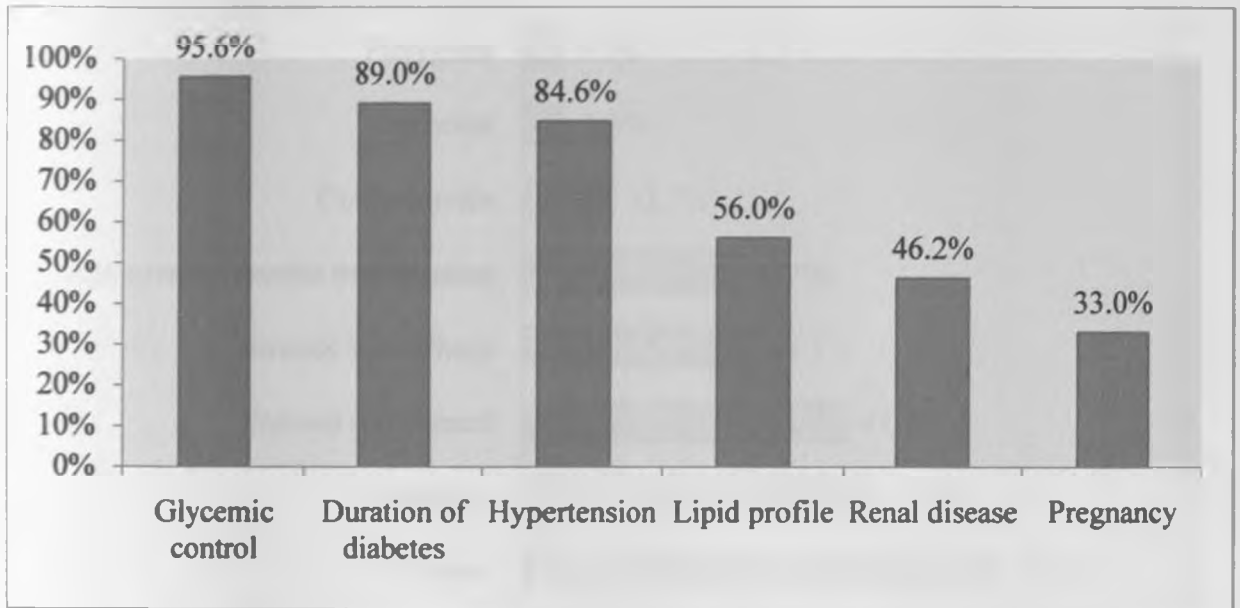
All the participants were aware that diabetes causes damage to the eyes.

Figure 1: Knowledge on functions impaired by diabetes mellitus (n=91)



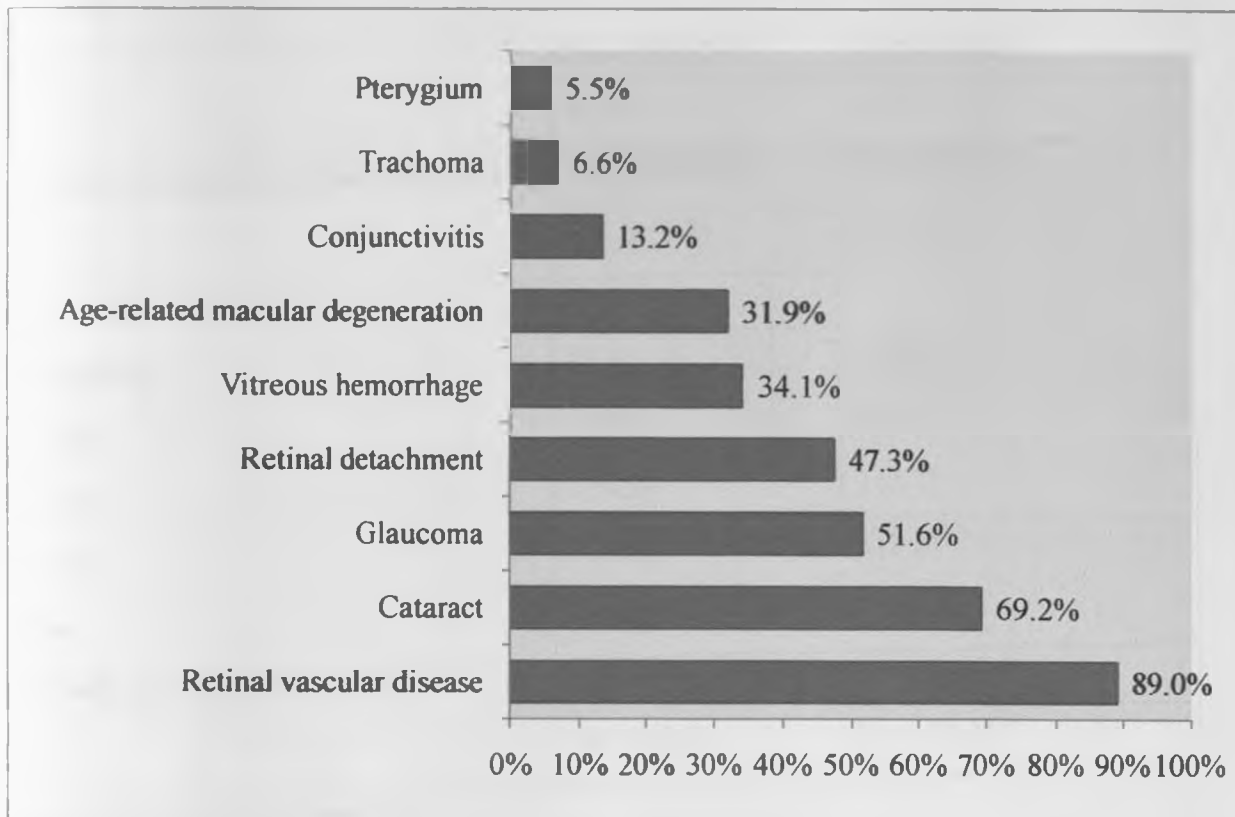
The participants indicated the functions they know to be impaired in diabetes mellitus. All were aware that diabetes impairs vision.

Figure 2: Knowledge on factors influencing presence or severity diabetic retinopathy (n=91)



The study participants were aware of glycemic control (95.6%), hypertension (84.6%) and duration of diabetes (89.0%) as influencing severity of diabetic retinopathy.

Figure 3: Knowledge on eye conditions associated with diabetes mellitus (n=91)



Eighty nine percent of the participants were aware that DM is associated with retinal vascular disease. More than half were aware of glaucoma and cataract (69.2% and 51.6% respectively) being associated with DM.

Table 2: Knowledge on eye examination for Type 1 and Type 2 diabetic patients among GPs (n=91)

Variable	Type 1 DM (%) (n=91)	Type 2 DM (%) (n=91)
Should visit eye specialist after diagnosis?	Yes 89 (97.8) No 2 (2.2)	Yes 89 (97.8) No 2(2.2)
Duration after diagnosis		
Immediately	75, (85.2)	75 (84.3)
01 years	5 (5.7)	9 (2.2)
02 years	4 (4.5)	2 (2.2)
05 years	4 (4.5)	2 (2.2)
Other	1 (1.1)	1 (1.1)
Should visit eye specialist regularly?	Yes 86 (94.5) No 5 (5.5)	Yes 90 (98.9) No 1 (1.1)
Frequency of regular eye check up		
Every year	65 (75.6)	71 (78.9)
Every 2 years	6 (7.0)	5 (5.6)
Every 5 years	7 (8.1)	3 (3.3)
Other	8 (9.3)	11 (12.2)

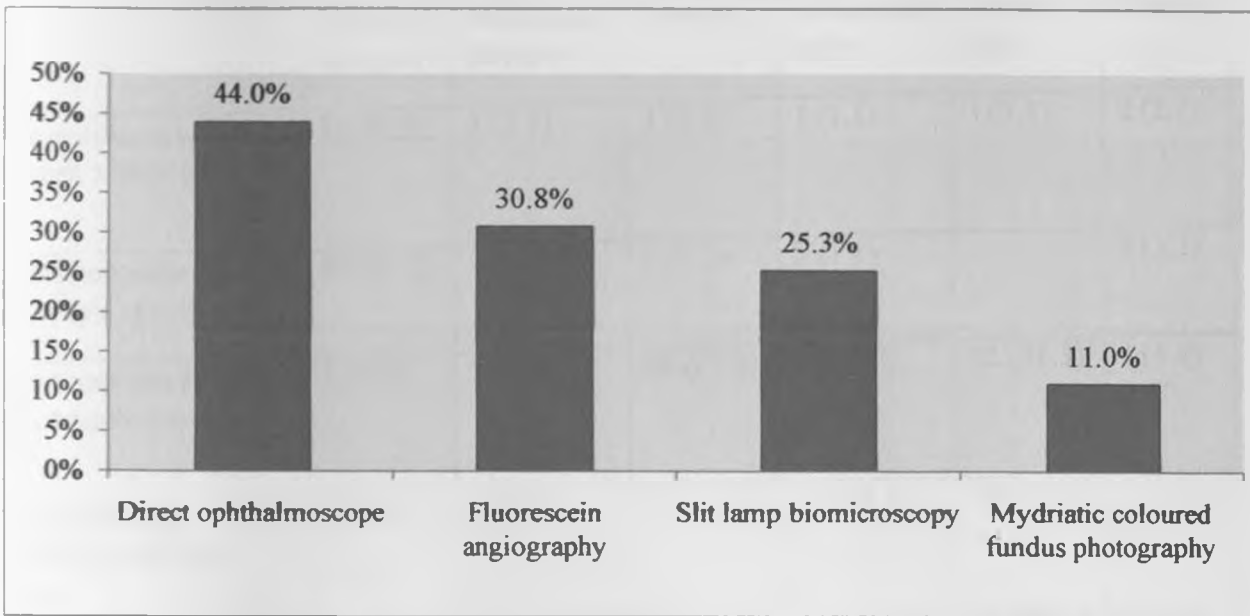
The general practitioners interviewed 89% were aware that diabetic patients both type 1 and 2 should be screened for diabetic retinopathy and have regular eye checkup (86% for type 1 DM and 90% for type two DM)

Table 3: Knowledge on treatment of diabetic retinopathy (n=91)

Variable	Frequency (%) (n=91)
Is diabetic retinopathy treatable?	Yes 61 (67.0) No 30 (33)
Treatment modalities	
Laser therapy	43 (47.3)
Glycemic control	10 (11.0)
surgery	10(11)
Use of steroids,	3 (3.3)
Cryotherapy	1 (1.1)

Among the GPs interviewed, 67% were aware that diabetic retinopathy is a treatable condition.

Figure 4: Knowledge on methods for detecting diabetic retinopathy (n=91)



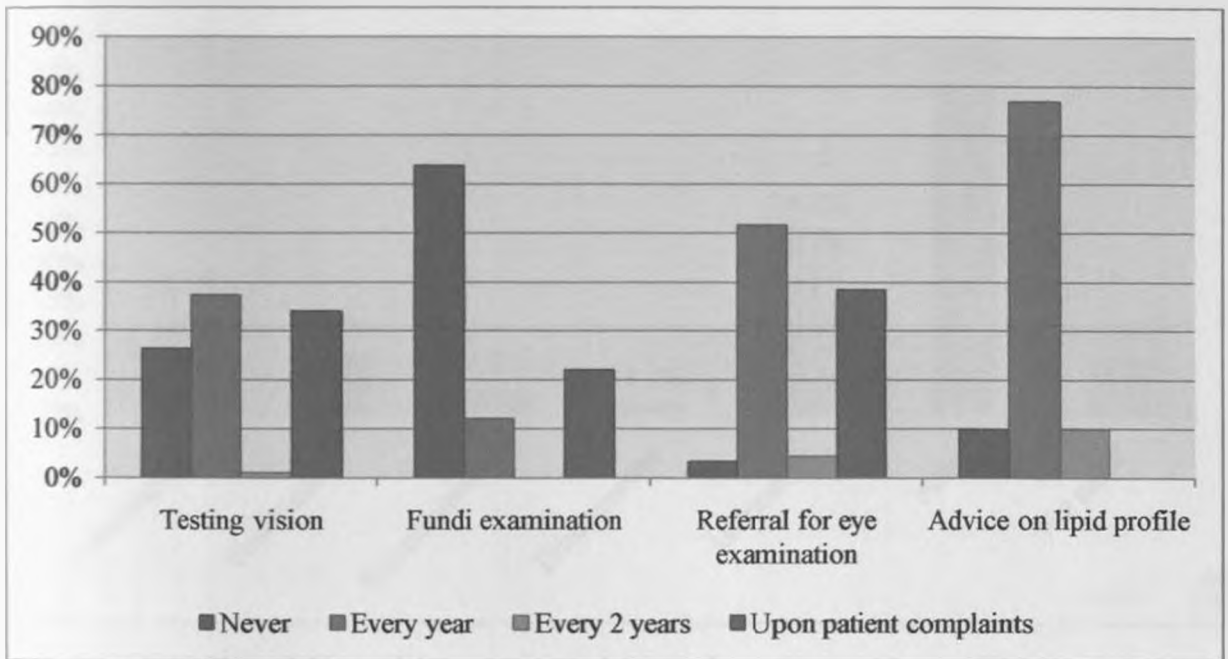
Direct ophthalmoscopy was felt to be the ideal method for screening for DR by 44% of the GPs.

Table 4: Attitudes towards eye examination among general practitioners (n=91)

	Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree	Missing
Eye examination only needed when vision is affected	80 (87.9)	3 (3.3)	2 (2.2)	1 (1.1)	3 (3.3)	2 (2.2)
Newly detected patients do not require eye check ups	83 (91.2)	4 (4.4)	1 (1.1)	1 (1.1)	-	2 (2.2)
Laser treatment can prevent blinding complications of DR	2 (2.2)	2 (2.2)	25 (27.5)	20 (22.0)	38 (41.8)	4 (4.4)
Good lipid profile is essential for preventing vision loss	3 (3.3)	3 (3.3)	14 (15.4)	30 (33.0)	39(42.9)	2 (2.2)
Fluoresceine angiography is essential for diagnosis	11 (12.1)	7 (7.7)	29 (31.9)	17 (18.7)	21 (23.1)	6 (6.6)

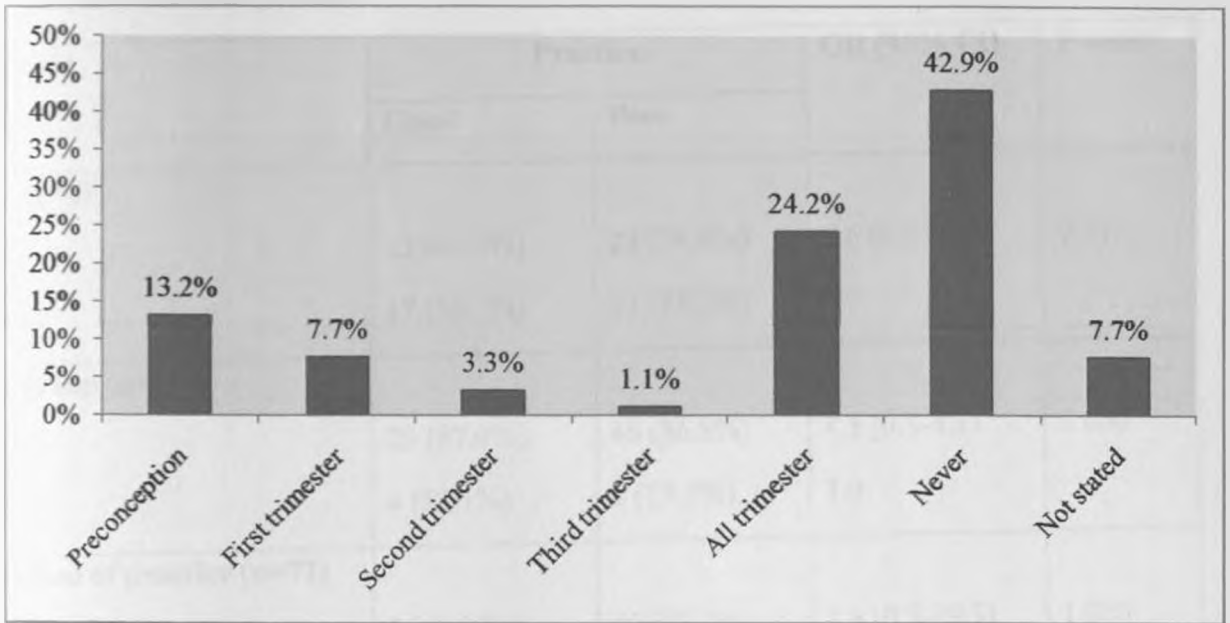
The general practitioners (87.9) in this study strongly disagreed that eye examination was only required when vision is affected. Among those interviewed 91.2% were of the opinion that newly detected diabetic patients require eye check up.

Figure 5: Eye examination on diabetic patients by GPs (n=91)



Only 37.4% of GPs in this study would test the vision of their diabetic patients every year with 12.1% performing yearly retinal examination.

Figure 6: Stage of pregnancy when retinal examination is advised in patients



Almost half (42.9%) of the participants never advise their pregnant patients with pre-existing diabetes mellitus to have an eye check up.

Table 5: Association between the age, gender and duration of practice of GPs and vision assessment of diabetic patients

Variable	Practice		OR (95% CI)	P value
	Good	Poor		
Sex (n=81)				
Male	13 (43.3%)	28 (54.9%)	0.6 (0.3-1.6)	0.315
Female	17 (56.7%)	23 (45.1%)	1.0	
Age group (n=86)				
<30	29 (87.9%)	46 (86.8%)	1.1 (0.3-4.1)	1.000
≥30	4 (12.1%)	7 (13.2%)	1.0	
Duration of practice (n=71)				
<5	26 (96.3%)	41 (93.2%)	1.9 (0.2-19.3)	1.000
≥5	1 (3.7%)	3 (6.8%)	1.0	

No association noted between the gender, age and duration of GPs and practice on vision assessment (p-value > 0.05).

N/B: Good practice was taken as those GPs who assessed vision every year while poor practice was those who never assessed vision or only did so when patients complained of visual symptoms

Table 6: Association between sex, age and duration of practice of GPs and fundus examination of diabetic patients

Variable	Practice		OR (95% CI)	P value
	Good	Poor		
Sex (n=80)				
Male	4 (36.4%)	36 (52.2%)	0.5 (0.1-2.0)	0.330
Female	7 (63.6%)	33 (47.8%)	1.0	
Age group (n=85)				
<30	9 (81.8%)	65 (87.8%)	0.6 (0.1-3.4)	0.630
≥30	2 (18.2%)	9 (12.2%)	1.0	
Duration of practice (n=71)				
<5	9 (100.0%)	58 (93.5%)	0.9 (0.8-1.0)	1.000
≥5	0 (0.0%)	4 (6.5%)	1.0	

No association noted between sex, age and duration of practice of the GPs and fundus examination (p-value >0.05).

N/B: Good practice was taken as those GPs who examined the fundus of their patient while poor practice was those who never examined the fundus or only did so when patients complained of visual symptoms

Table 7: Association between sex, age and duration of practice of GPs and referral practices for diabetic patients to eye specialists

Variable	Practice		OR (95% CI)	P value
	Good	Poor		
Sex (n=80)				
Male	17 (41.5%)	23 (59.0%)	0.5 (0.2-1.2)	0.117
Female	24 (58.5%)	16 (41.0%)	1.0	
Age group (n=85)				
<30	39 (88.6%)	35 (85.4%)	1.3 (0.4-4.8)	0.654
≥30	5 (11.4%)	6 (14.6%)	1.0	
Duration of practice (n=70)				
<5	38 (95.0%)	28 (93.3%)	1.4 (0.2-10.2)	1.000
≥5	2 (5.0%)	2 (6.7%)	1.0	

No association found between referral practices and sex, age or duration of practice of the GPs (p-value >0.05).

N/B: Good practice was taken as those GPs who referred patients for yearly eye examination while poor practice was those who never referred or only did so when patients complained of visual symptoms

Table 8: Reasons hindering examination of diabetic patients for DR

	n=91	%
Lack of equipment - ophthalmoscopes	67	73.6
Lack of skill	25	27.5
Workload/ lack of time	13	14.3
Patients cooperation	4	4.4
Lack of funds among patients	1	1.1
Medical complications	1	1.1
Lack of Mydriatic drops	1	1.1

On assessing the factors that hinder GPs from examining the eyes of their diabetic patients 73.6% quoted lack of equipment as being the major challenge.

7. DISCUSSION

This study recruited ninety one general practitioners working at the seven provincial hospitals in Kenya. In the study we sought to assess the knowledge, attitudes and practice of general practitioners toward diabetic retinopathy.

The male to female ratio was one to one although nine participants did not indicate their gender. The mean age was 27.8 years with range from 22 to 48 years, thus the population was that of relatively young doctors. This could be due to the fact that general practitioners in public health facilities in Kenya tend to be the younger doctors who have recently graduated from medical school. The provincial hospitals serve as internship centers thus majority of the doctors there would be young graduates. After serving for a few years most of these doctors go back to school for specialist training. The mean duration of practice for the study participants was one year (IQR 1-2) with 96.7% indicating that they were engaged in general practice. (Table 1)

All the GPs (100%) who participated in the study were aware that diabetes could damage the eyes and impair eyesight. This compares well to a study in Myanmar by Muecke et al where 98% and 99% respectively of GPs interviewed were aware that diabetes mellitus can damage eyes and impair vision.²⁵

The GPs had a good level of knowledge on the other complications of diabetes including renal disease (98.9%), heart disease (92.3%) and diabetic foot (94.5%) and impaired sexual activity 95.6%. This is similar to a study by Mahesh et al in India where 93.6% of GPs in the study were aware of the blinding and other complications of DM.²⁷

The GPs in our study were knowledgeable regarding the factors that affect presence or severity of diabetic eye disease. Of those interviewed 95.6% indicated that glycemic control affected presence and severity of DR, 89% indicated duration as a factor and 84.6% indicated hypertension. Among the GPs in the study, 56% were aware of the effect of lipid profile as having any relation to DR though in practice 76.9% advice yearly lipid profiling. This would mean that there are those who advice lipid profiling not necessarily to reduce risk of DR but other complications perhaps.

Only 33% were aware of pre-existing diabetes mellitus in pregnant women as being a risk factor for progression of DR. This was also evident when asked about advising pregnant women with pre-existing diabetes; with 42.9% never advising on eye check for this group of patients.

The lack of awareness among the GPs in this study of the serious ophthalmic complications of diabetes such as vitreous haemorrhage (65.9%) and retinal detachment (52.7%), suggests that though the GPs are aware that DM affects the eyes the specific ocular complications are unknown to many of them. This inadequacy may be informing the poor practice patterns as regards vision assessment and fundus examination of diabetic patients. It may mean that the GPs would be more proactive in the screening and referrals of diabetic patients if they were aware of the potential blinding complications.

Muecke et al also found a lack of awareness among the Yangon GPs on the serious ophthalmic complications of diabetes such as vitreous hemorrhage (43%) and retinal detachment (44%), and recommended medical school curriculum refreshing in their study.²⁵

The knowledge gap thus established in our study may need to be addressed through educational programs to educate GPs on diabetic retinopathy and its blinding complications. Emphasis on blinding complications of DM and the need for screening and referral for DR in the medical school curriculum may also bridge this gap and prevent this cause of avoidable blindness.

Regarding knowledge on examination of diabetic patients for DR most of the GPs were aware that DM patients require eye examination upon diagnosis but could not differentiate where this applies in regard to type of diabetes.

The American academy of ophthalmology recommends that type 1 diabetics be screened within the first five years of diagnosis and type 2 diabetics screening for DR be done immediately upon diagnosis.²² Type 1 diabetics rarely develop DR in the pre-adolescent years thus screening for DR is recommended within 5 years of diagnosis. Type 2 diabetics require immediate DR screening at diagnosis because the duration of the disease is usually uncertain thus may present with DR at the time of diagnosis. The GPs in our study may have been better placed to screen diabetic patients had they been aware of these recommendations.

A number of landmark multicentre studies have demonstrated that severe vision loss from diabetic retinopathy may be preventable if the disease is detected early and treated in a timely manner.^{7,14,16,17} In our study 33% of GPs were not aware that diabetic retinopathy is treatable with a significant proportion not being aware of the modes of treatment available. This is an important finding because it may influence the way GPs manage and refer patients. If they believe there is no treatment they may not see the need to screen or refer diabetic patients.

Most of the GPs were not aware on the ideal method for fundus examination in assessing for diabetic retinopathy. There was misconception among some of the GPs who thought that fluorescein angiography is ideal for detecting diabetic retinopathy. This compares to a study in India by Mahesh et al where 75.86% of physicians thought that FLA is required for evaluation of all diabetic retinopathy cases. This may indicate that probably the GPs think that diagnosis of DR requires complex instruments thus they don't try to assess for it.

Despite a vast majority of GPs having the attitude that eye examination is not only required when vision is affected, more than half of them never test vision or perform fundus examination on their diabetic patients. Only 38 (41.8%) of the GPs in this study agreed strongly that laser can prevent blinding complications of DR. This proportion is lower than the 87.9% of respondents who agreed that laser could prevent blinding complications in a study in India by Mahesh et al.²⁷

The practice patterns of the general practitioners as regards DR show disparity between the knowledge level and practice. While the level of knowledge could be labeled as adequate on most of the issues this is not true for the practice. Less than half (37.4%) of the GPs in our study examine vision of their diabetic patients. Majority of GPs never examine vision (26.4%) or only do so when a patient complains of visual disturbance (34.1%). Concerning fundus examination, 58% of GPs in our study never perform retinal examination for their patients. This compares well with a study in Oman where Khandekar et al found that only 10 of the 40 GPs interviewed in their study had ever tried to use an ophthalmoscope in the course of their work.²⁹

This finding is disconcerting since the participants in the study were young doctors, recently graduated from medical school. One would expect that they would be keen to assess vision and retina as an indicator of the patient's microvascular state in other organs such as kidneys.

Regardless of whether the GPs examine the fundi or not, all patients should be referred to an ophthalmologist for regular fundus examination as recommended by AAO. Among the GPs in our study, 51.6% refer and advise yearly eye examination of diabetic patients while 38.5% refer only when the patient complains of visual disturbance. This is less than ideal and may be the reason diabetic patients are seen at eye clinics already with advanced DR. By the time the patient has visual symptoms DR may have progressed requiring complex and expensive management. The American Academy of Ophthalmology recommends that an ophthalmologist examine all diabetic patients at least annually. This is possible in the setting of provincial hospitals in Kenya since each of the seven hospitals has a resident general ophthalmologist. All that would be required is a screening program modeled along that of Kenyatta National Hospital where diabetic patients seen in the medical outpatient clinic are referred to the eye clinic for screening. A recent study on the prevalence and pattern of DR in the hospital found that at least 42% of the diabetics interviewed had eye examination a marked improvement from 18% 12 years before.^{12, 32}

Pre-existing diabetes mellitus in pregnancy has been noted to exacerbate progression of DR, in their practice 42.9% of the GPs in our study never advice eye check up in these patients with only 7.7% advising check up in the first trimester. This is consistent with the fact that the GPs were not aware of pregnancy as being a risk factor for DR.

Gender, age or duration of practice of the GPs did not influence practice toward diabetic retinopathy (Tables 5,6,7). No association was found between these factors and practice patterns of the GPs in our study.

This study also sought to establish the factors or challenges that hinder the practice of GPs in screening for diabetic retinopathy.

Lack of equipment such as ophthalmoscopes and vision charts was the most common factor that the GPs felt hindered them from performing eye examination. This was indicated by 73.6% of the study participants. Twenty five GPs felt they lacked the skill to perform funduscopy appropriately and detect signs of DR. Other factors include lack of time, patients not cooperating and lack of funds among patients to pay for specialist eye examination. This findings compared with those of a studies by Muecke et al in Myanmar did not assess for factors that hindered practice but postulated that lack of equipment, time and familiarity with signs of DR on performing funduscopy may have been the cause of in action by GPs in their study.

8. CONCLUSION

- This study establishes that despite the high level of knowledge among GPs on DR, there are existing gaps such as lack of knowledge on the sight threatening complications of diabetic retinopathy.
- The attitude of the GPs in the study toward DR is good though there are misconceptions concerning laser and FLA.
- The good attitude though does not translate to good practice with failure to assess vision, carry out funduscopy and refer diabetics to an ophthalmologist by majority of GPs.
- The main barriers hindering GPs included lack of time, equipment and skill on performing funduscopy.

9. STUDY LIMITATIONS

- Only general practitioners in the seven provincial hospitals were included in the study. There may be differences in KAP between these GPs and those in referral centers or peripheral health facilities. Thus it may be difficult to extrapolate the findings as being the true picture of all GPs in Kenya.
- Majority GPs interviewed had been in practice for only a short duration, it would be of benefit to also find out KAP among the older GPs.

10. RECOMMENDATIONS

- Re-training of general practitioners on diabetic retinopathy and its blinding complications. This can be done through continuous medical education at health facilities and regular skills update workshops.
- Reassessing the curriculum in medical school so that medical students get more hands on training on eye examination.
- Building the capacity of the general practitioners through provision of basic equipment such as vision charts and ophthalmoscopes.
- Creating awareness among diabetics regarding the blinding complications of DM so as to increase demand for early referral to an ophthalmologist and as such reduce the blinding impact of DM.

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Appendix 1: AAO screening guidelines for diabetic retinopathy

Patient group	Recommended first examination	Minimum routine follow-up*
29 years or younger	within 3-5 years after diagnosis	yearly
30 years and older	at time of diagnosis of DM	yearly
Pregnancy in pre-existing DM	Prior to conception and during 1 st trimester	Less than severe NPDR every 3-12 months; otherwise, every 1-3 months

*Abnormal findings may necessitate more frequent examinations

3. Please indicate (tick) which of the following factors below influence presence or

Severity diabetic retinopathy

- | | |
|-----------------------------|-------------------------|
| 1. Duration of diabetes [] | 2. Glycemic control [] |
| 3. Hypertension [] | 4. Lipid profile [] |
| 5. Renal disease [] | 6. Pregnancy [] |

4. Which of the following eye diseases are seen with increased frequency in diabetes?

Please tick [√] your choice or choices (you may tick more than one)

- | | |
|---|-----------------------|
| 1. Pterygium [] | 2. Glaucoma [] |
| 3. Retinal vascular disease [] | 4. Cataract [] |
| 5. Age related macular degeneration [] | 6. Trachoma [] |
| 7. Vitreous hemorrhage [] | 8. Conjunctivitis [] |
| 9. Retinal detachment [] | |

5. Do you think that a person with Type 1 diabetes mellitus should visit a specialist eye doctor following diagnosis?

Please tick [√] your choice:

1. Yes []
2. No []

6. If you answered 'yes' to Question 5 above, then how soon after the diagnosis has been made should that person visit the specialist eye doctor?

Please tick [√] your choice (tick only one):

- | | |
|------------------------------------|-----------------------------------|
| 1. Immediately after diagnosis [] | 2. One year after diagnosis [] |
| 3. Two years after diagnosis [] | 4. Five years after diagnosis [] |
| 5. Other _____ | |

7. Do you think that a person with Type 1 diabetes mellitus should visit a specialist eye doctor on a regular basis following diagnosis?

Please tick [√] your choice:

1. Yes []
2. No []

8. If you answered 'yes' to Question 7 above, then how often should that person visit the specialist eye doctor?

Please tick [√] your choice (tick only one):

1. Every year []

3. Every 5 years []

2. Every 2 years []

4. Other _____

9. Do you think that a person with Type 2 diabetes mellitus should visit a specialist eye doctor following diagnosis?

Please tick [√] your choice:

1. Yes []

2. No []

10. If you answered 'yes' to Question 9 above, then how soon after the diagnosis has been made should that person visit the specialist eye doctor?

Please tick [√] your choice (tick only one):

1. Immediately after diagnosis []

2. One year after diagnosis []

3. Two years after diagnosis []

4. Five years after diagnosis []

5. Other _____

11. Do you think that a person with Type 2 diabetes mellitus should visit a specialist eye doctor on a regular basis following diagnosis?

Please tick [√] your choice:

1. Yes []

2. No []

12. If you answered 'yes' to Question 11 above, then how often should that person visit the specialist eye doctor?

Please tick [√] your choice (tick only one):

1. Every year []

2. Every 2 years []

3. Every 5 years []

4. Other _____

13. Is diabetic retinopathy treatable?

1. Yes []

2. No []

14. If you answered yes to question 13 above, please name any treatment modalities

15. Which of the methods below is ideal for detecting diabetic retinopathy?

1. Slit lamp biomicroscopy

2. Fluorescein angiography

3. Mydriatic colored fundus photography

4. Direct ophthalmoscope

Practice

1. How often do you test the vision of your diabetic patients?

Please tick [√] your choice (tick only one):

1. Never []

2. Every year []

3. Every 2 years []

4. Only when a patient complains of trouble with their eyesight []

2. How often do you examine the fundi of your diabetic patients?

Please tick [√] your choice (tick only one):

1. Never []

2. Every year []

3. Every 2 years []

4. Only when a patient complains of trouble with their eyesight []

3. How often do you refer diabetic patients for eye examination?

- 1. Never []
- 2. Every year []
- 3. Every 2 years []
- 4. Only when a patient complains of trouble with their eyesight []

4. How often do you advise lipid profile in your diabetic patients?

- 1. Never []
- 2. Every year []
- 3. Every 2 years []

5. How often do you advise retinal examination in pregnant diabetic patients?

- 1. Preconception []
- 2. First trimester []
- 3. Second trimester []
- 4. Third trimester []
- 5. All trimesters []

6. Indicate any challenges that hinder examination of DM patients for diabetic

Retinopathy

Attitudes

For each of the questions below indicate whether you strongly disagree, moderately disagree, neutral, moderately agree, strongly agree

1. Eye examination is only required in diabetic patients when vision is affected

- Strongly disagree []
- Moderately disagree []
- Neutral []
- Moderately agree []
- Strongly agree []

2. Newly detected diabetic patients do not require eye check ups

- Strongly disagree []
- Moderately disagree []
- Neutral []
- Moderately agree []
- Strongly agree []

21 treatment can prevent blinding complications of diabetic retinopathy

- Strongly disagree
- Moderately disagree
- Neutral
- Moderately agree
- Strongly agree

22 A good lipid profile is essential for preventing vision loss in diabetic retinopathy

- Strongly disagree
- Moderately disagree
- Neutral
- Moderately agree
- Strongly agree

23 Fluorescein angiography is essential for diagnosis of diabetic retinopathy

- Strongly disagree
- Moderately disagree
- Neutral
- Moderately agree
- Strongly agree

Appendix 3: consent form

Participants consent to participate in a study seeking to determine and assess the knowledge, attitudes and practices among general practitioners towards diabetic retinopathy.

Kindly read the attached study background and explanation carefully before signing this consent form.

Your participation in this study is highly appreciated.

Declaration

I Dr R Oenga have fully explained the study and its purpose to the participant in writing by way of the explanation attached to this consent form.

The participant is aware that participation is on a voluntary basis and all data collected will be handled and stored in a confidential manner.

Signature.....

Declaration

I accept that I have read and understood the explanation attached to this consent form and I am willing to participate in the study on a voluntary basis.

Signature.....

Appendix 4: Consent explanation

Consent explanation for a study on Knowledge, Attitudes and Practice among general practitioners toward diabetic retinopathy

The number of people with diabetes is increasing due to population growth, aging, urbanization and an increase in obesity.

The greatest increase in prevalence of diabetes will occur in sub-Saharan Africa. As such diabetic retinopathy a leading cause of blindness will also increase in prevalence.

Studies done in Kenya and elsewhere have shown that diabetic patients present to the eye specialist late. In Kenya as is true for most of the developing world patients will most often be under the care of a general practitioner.

Thus this study seeks to understand if there may be an existing gap in knowledge attitudes and practices among GP's that may be the underlying reason for the patients presenting late to eye clinics.

The data acquired will form a baseline on which intervention can be planned addressing any existing gap.

The Information will be also be useful to policy makers who can seek to change the way things are done to promote eye examination of diabetic patients.

By participating in the study we also hope to draw your attention to diabetic retinopathy as a complication of DM.

The data collected will be confidential: the questionnaire will not have any identifiers of the individual participant nor the hospital; the data will be entered into a database whose pass word will be with the researcher only.

Participating in the study will not contribute to your work appraisal.

Thank you.

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