SITUATION ANALYSIS OF DIABETIC RETINOPATHY SERVICES IN KENYA

A DISSERTATION SUBMITTED AS PART FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE IN OPHTHALMOLOGY OF THE UNIVERSITY OF NAIROBI

BY

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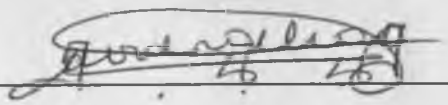
DECLARATION

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

SIGNED  DATE 5/3/2009

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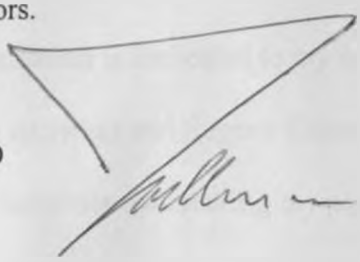
APPROVAL

This dissertation has been submitted for the examination with our approval as university supervisors.

SIGNED  DATE 6.3.09

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DEDICATION

This dissertation is dedicated to my spouse Christine Natome and my children Hilda Achwa, Michelle Akuwam and Eugene Ekeno for the continuous support, encouragement and patience given to me while undertaking my postgraduate studies.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ADA	American Diabetes Association
AFMH	Armed Forces Memorial Hospital
CBM	Christoffel Blinden Mission
CO	Clinical Officer
CSME	Clinically Significant Macular Oedema
DCCT	Diabetes Control and Complications Trial
DH	District Hospital
DM	Diabetes Mellitus
DR	Diabetic Retinopathy
DMOH	District Medical Officer of Health
DOS	Division of Ophthalmic Services
DRS	Diabetic Retinopathy Study
DRVS	Diabetic Retinopathy Vitrectomy Study
EDICT	Epidemiology of Diabetes Intervention and Complications Trial
ETDRS	Early Treatment Diabetic Retinopathy Study
HRD	Human Resources Development
ICO	International Council of Ophthalmology
IDDM	Insulin Dependent Diabetes Mellitus
IEC	Information, Education, Communication
IGT	Impaired Glucose Tolerance
KEU	Kikuyu Eye Unit
KMTC	Kenya Medical Training College
KNH	Kenyatta National Hospital
KNH-ERC	Kenyatta National Hospital Ethics and Research Committee
KOP	Kenya Ophthalmic Programme
KSB	Kenya Society for the Blind
LVT	Low Vision Therapist
MCH	Maternal and Child Health
Mmol/l	Millimoles per litre

MOH	Ministry of Health
MOPC	Medical Out-Patient Clinic
NGO	Non Governmental Organisation
NHSSP	National Health Sector Strategic Plan
NIDDM	Non-Insulin Dependent Diabetes Mellitus
NPBC	National Prevention of Blindness Committee
NPBWG	National Prevention of Blindness Working Group
NPDR	Non-proliferative Diabetic Retinopathy
OCO/CS	Ophthalmic Clinical Officer / Cataract Surgeon
OGTT	Oral Glucose Tolerance Test
ON	Ophthalmic Nurse
PDR	Proliferative Diabetic Retinopathy
PEC	Primary Eye Care
PES	Provincial Eye Surgeon
PGH	Provincial General Hospital
PHC	Primary Health Care
PMO	Provincial Medical Officer
POAG	Primary Open Angle Glaucoma
PPV	Pars Plana Vitrectomy
SBW	Sight by Wings
SPSS	Statistical Package for Social Scientists
SWA	Sector Wide Approach
TRH	Teaching and Referral Hospital
UKPDS	United Kingdom Prospective Diabetes Study
UN	United Nations
UON	University of Nairobi
US	United States of America
VR	Vitreo-Retinal
WHO	World Health Organization
ZES	Zonal Eye Surgeon

ABSTRACT

Objective: To analyze the situation of diabetic retinopathy services in Kenya.

Design: Cross-sectional hospital based study.

Setting: Medical out-patient clinics and Eye units.

Subjects: A total of eighty facilities across the country were reviewed between May and October 2008 .All District Hospitals and eye units run by the Government were included in the study. All NGO/Voluntary facilities providing general health as well as eye care services were also included, whereas private for profit health facilities were excluded for logistical reasons. Key informants were identified from medical outpatient clinics and eye units and interviewed on their health facilities' capacity (personnel, infrastructure, equipment, and supplies); services delivery; referral and linkages with respect to diabetes mellitus and diabetic retinopathy services.

Results: All eye units in the country were covered while 80.3% coverage was obtained for district hospital. Ten per cent (10%) of the facilities were run by NGO/Voluntary organizations whereas 90% were Government facilities. There was a skewed geographical distribution of facilities since 72.5% were found in half of the provinces namely Rift-Valley, Coast, Eastern and Central provinces. Diabetics constitute about 8.0 % of all medical outpatients in Kenya. Nairobi had the highest number of diabetics 17,454 (24.5%) and North- Eastern province the lowest at 1,060 (1.5%). 79.0% of known diabetics are found in Rift-Valley, Central, Nairobi and Coast provinces. About 28.8 % of all diabetics are referred to eye care specialists for screening for diabetic retinopathy. Central province referred 34.3 % of their diabetics to eye care specialists for evaluation whereas Nyanza referred only 15.7 %. Diabetics are mainly managed by general practitioners and general clinical officers who partner with nutritionists, ophthalmologists and ophthalmic clinical officers. Screening for diabetic retinopathy is performed mainly by ophthalmologists and ophthalmic clinical officers by dilated direct ophthalmoscopy. Accurate grading of diabetic retinopathy poses a challenge to most clinicians including many eye care workers as there is no uniform grading system in use as an acceptable minimum standard for assessing diabetic retinopathy. Nairobi was found to have the highest prevalence of diabetic retinopathy of 40.0% while North-Eastern had a prevalence of 9.2%. The median national prevalence of diabetic retinopathy in selected health facilities is 15.4%. The number of diabetics seen in the eye clinics is higher than the number referred from medical outpatient clinics. These findings may be due to large numbers of diabetics arising from self referrals and early. Most eye care workers recognize PDR (93.8%) and CSME (86.2%) as indications for retinal laser photocoagulation. All eye units eventually referred patients with diabetic retinopathy to either Kenyatta National Hospital or Kikuyu Eye Unit for laser or vitreo-retinal surgical interventions

Conclusion: The distribution of diabetic retinopathy services poses a challenge for prompt treatment and specialist review. Organization of effective referral chains between primary, secondary and tertiary eye care workers and public health measures aimed at prevention of diabetes and visual loss is needed.

Recommendations: There is need for diabetic eye health training and re- training among health care providers and adoption of uniform guidelines regarding grading and referral threshold for diabetic retinopathy. In view of the skewed distribution of treatment facilities, the threshold for referral could be lowered besides availing laser at secondary level facilities. The role of mass media and research in combating blindness has not been fully exploited.

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 DIABETES MELLITUS

1.1.1 Definition

In 1999, WHO defined diabetes mellitus as a metabolic disorder of multiple aetiology, characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs [1]. Thus, the metabolic abnormalities of diabetes result from inadequate insulin action on target tissues, due to deficient insulin action, or a combination of both [2].

1.1.2 Classification

The classification of diabetes mellitus has evolved considerably over time, taking into account advances in the diabetes field. The classification is now primarily based on the aetiology (causes) of the disease, rather than its treatment. The revised classification encompasses both clinical stages and etiological types of hyperglycaemia and results from improved understanding of the causes of diabetes mellitus [1].

The clinical staging reflects that diabetes mellitus, regardless of its aetiology, progresses through several clinical stages during its natural history. Individuals can move from one stage to another in either direction. The severity of glycaemia may change over time depending on the extent of the underlying disease processes. While there are autoimmune markers that help identify type 1 diabetes mellitus, there are few sensitive or highly specific indicators of the type 2 process at present. The same disease process leading to type 2 diabetes mellitus can cause impaired fasting glycaemia and / or impaired glucose tolerance without fulfilling the criteria for the diagnosis of diabetes mellitus.

In some individuals with type 2 diabetes, adequate glycaemic control can be achieved with weight reduction, exercise and / or oral agents. These individuals, therefore, do not require insulin and may even revert to impaired glucose tolerance (IGT) or normoglycaemia.

Other individuals require insulin for adequate glycaemic control but can survive without it. These individuals, by definition, have some residual insulin secretion.

Individuals with extensive B-cell destruction, and therefore no residual insulin secretion, require insulin for survival. The severity of the metabolic abnormality can regress (e.g. with weight reduction), progress (with weight gain) or stay the same [1].

There are two main types of diabetes: type 1 (requiring insulin for survival) and type 2 (may or may not require insulin for metabolic control). It is recommended that the terms insulin dependent DM and non-insulin dependent DM and their acronyms IDDM and NIDDM, no longer be used. These terms are confusing and frequently result in patients being classified on the basis of treatment rather than aetiology [1].

Type 1 DM encompasses the majority of cases, which are primarily due to pancreatic islet B cell destruction and are prone to ketoacidosis. Type 1 includes those cases attributable to autoimmune processes, as well as B-cell destruction for which neither aetiology nor pathogenesis is known (idiopathic). It does not include those forms of B cell destruction or failure to which specific causes can be assigned e.g. cystic fibrosis, mitochondrial defect [1, 2, 3].

Type 2 DM is the common major form of diabetes mellitus which results from defect(s) in insulin secretion, almost always with a major contribution from insulin resistance.

Other specific types of DM are less common, but are conditions in which the underlying defect or disease process can be identified in a relatively specific manner e.g. diseases of the exocrine pancreas, such as cancer of the pancreas.

Gestational diabetes is a state of carbohydrate intolerance resulting in hyperglycaemia of variable severity, with onset or first recognition during pregnancy. The definition applies irrespective of whether, or not insulin is used for treatment, or whether the condition persists after pregnancy. [1, 3].

1.1.3 Epidemiology

Diabetes mellitus is one of the most common non-communicable diseases, and its epidemic proportion has placed it at the forefront of public health challenges facing the world. In estimating the total number of persons with diabetes mellitus, we cannot rely solely on reported numbers of diagnosed cases. It is estimated that about half of persons with diabetes are unaware of their disease and, even in industrialized countries, many individuals go undiagnosed. Although more recent data show that the proportion of undiagnosed cases has decreased in some areas, it is still at least about one quarter to one third of all persons with diabetes mellitus [1].

It is predicted that between 2000 and 2025, the size of the world's adult population will increase from almost 4 billion to 5.5 billion, mainly on account of a 60% increase in developing countries [1]. At the same time the number of adults with diabetes in the world is predicted to increase from 150 million in 2000 to 300 million in 2025 [2]. In industrialized countries, the number of diabetics will increase by about one third between 2000 and 2025, while in developing countries that number will more than double [2]. Thus, in 2025, more than 75% of the world's diabetic population will be living in developing countries.

These projections of the number of people with diabetes take into account the fact that there will be more people in the world (population growth) and that there will be more elderly people (population ageing). They also take into account trends in urbanization, physical inactivity, and obesity. In fact current trends in obesity suggest that these projections are conservative and that the increase in the prevalence of diabetes may be even greater [2].

In developing countries, it is the people in the middle, productive years of their lives that are particularly affected by diabetes. In these countries, three-quarters of all people with diabetes are under 65 years old and 25% of all adults with diabetes are younger than 44. In industrialized countries, more than half of all people with diabetes are older than 65, and only 8% of adults with diabetes are younger than 44 [1].

The prevalence of diabetes in persons 35-64 years in sub-Saharan Africa in 2000 is estimated 3-5% [4]. The number of people estimated to have diabetes by WHO in Kenya in 2000, was 183,000

and this was projected to increase to 498,000 by the year 2030 [5]. The US census bureau in its international data base in 2004 estimated that Kenya had 691,169 newly diagnosed diabetics whereas 1,940,124 had undiagnosed diabetes mellitus.

1.1.4 Risk factors

There is evidence that genetic factors, autoimmunity and possibly viral infection may all be involved in the aetiology and pathogenesis of type 1 diabetes mellitus [6].

The following major risk factors have been associated with the development of type 2 diabetes mellitus: obesity, hypertension, high cholesterol, family history, genetic predisposition, impaired glucose tolerance, ageing and race [7-9].

1.1.5 Clinical features

The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. DM may present with characteristic symptoms such as thirst, polyuria, blurring of vision and weight loss. In its most severe forms, ketoacidosis, or non-ketotic hyperosmolar state may develop and lead to stupor, coma and in the absence of effective treatment death.

Often symptoms are not severe or may be absent, and consequently hyperglycaemia sufficient to cause pathological and functional changes may be present for a long time before the diagnosis is made. The long-term effects of diabetes mellitus include diabetic neuropathy, nephropathy and retinopathy. People with diabetes are at an increased risk of cardiovascular, peripheral vascular and cerebrovascular disease [1].

1.1.6 Diagnosis

The symptoms and signs of overt diabetes are due to osmotic diuresis and hyperglycaemia. When a patient has these symptoms or is asymptomatic but has persistently elevated fasting plasma glucose levels it is generally agreed that diabetes mellitus is present.

Problems arise with asymptomatic patients who are considered potential diabetics but have normal fasting glucose concentrations. Such patients are often given oral glucose tolerance tests (OGTT) and if abnormal values are found diagnosed as having IGT or diabetes. Normal glucose tolerance is strong evidence against diabetes but the predictive value of a positive test is less certain. The test may overdiagnoses diabetes. On the other hand, the stress response of epinephrine, concomitant illness, inadequate diet and lack of physical exercise may give false positive results.

To reduce these problems, the US National Diabetes Data Group gave the following criteria for diagnosis of diabetes following a challenge with glucose:
Overnight fasting: venous plasma glucose > 7.8 mmol/l on at least two separate occasions.
Following ingestion of 75g glucose: at least two values of venous plasma glucose > 11.1 mmol/l at two hours on separate occasions.
If the 2 hours value is between 7.8 and 11.1 mmol/l on one occasion and >11.1 mmol/l on another occasion, a diagnosis of impaired glucose tolerance is suggested. Such a person is at high risk of developing fasting hyperglycaemia or overt diabetes.

1.1.7 Treatment

The backbone of diabetes management is proper diet and regular exercise, which have to be individualized. [7] Both could be the only management needed for controlling blood glucose in gestational diabetes, IGT and in type 2 diabetes in its early phase. Patients with type 2 diabetes may require oral hypoglycaemic agents and / or insulin, while type 1 patients need insulin therapy to survive. The treatment plan for diabetes may include diabetes education, meal planning and nutritional recommendations, exercise, oral anti-diabetic agents, insulin and the management of associated conditions and complications [3, 7, 9].

The care of an individual with diabetes mellitus requires a multidisciplinary team approach. Central to the success are the patient's participation, input and enthusiasm. Members of the health team should include primary care provider and or diabetologist, nutritionist, and diabetes educator. When complications arise, specialists including neurologists, nephrologists, vascular

surgeon, cardiologists and ophthalmologists are essential. Comprehensive diabete means that optimal therapy involves more than plasma glucose management. detect and manage diabetes mellitus complications and modify DM related risk of multidisciplinary mini - clinics for diabetes care has the potential to improve c These provide team care that will improve treatment and help establish a refe diabetic complications.[9]

1.1.8 Diabetic eye disease

Diabetes mellitus has been associated with lesions in the eye such as con aneurysms, reduced corneal sensation and tear production, thickened corneal s transient lenticular myopia during hyperglycaemia, iris neovascularisation (r thickened basement membrane at the pigment epithelium of the pars plicata, ar the choroids, obliterated lumen of the choriocapillaris at the macula, vitreous haemorrhage, diabetic retinopathy, drusen, glaucoma, optic disc neovascularis optic neuropathy, and central retinal vein occlusion. [10]

1.1.9 Regional status of diabetes care

While much work has been done in many countries to address diabetes, it is more is required. This is particularly true in the areas of screening, prever intervention. Diabetes is a costly disease in terms of morbidity, mortality and q constitutes a considerable financial burden on individuals, their families, the he governments. The American Diabetes Association (ADA) estimated the national the US for 2002 to be $ US 132 billion increasing to $US 192 billion in 20 countries in the third world, specialized diabetes centres are few and far apar within reach of many people with diabetes [2]. Likewise, trained and experienced and specialized eye care workers are few, nutritionists and diabetes nurse uncommon and chiropodists may be non-existent. Besides, the infrastructure at th level is often not capable of allowing the meticulous implementation of rou procedures, monitoring control and detecting common diabetes complications.

In addition, provision of care for diabetes may differ in the same country varying from very poor or almost non-existent care in some areas to highly structured care in other places [2]. In 2001 WHO carried out a global survey [12], the main objectives of which were to assess the current situation in relation to the existing capacity for non-communicable diseases, to identify constraints, and needs and to set priorities for technical support to member states. The majority of African countries were found neither to have national plans for the prevention of diabetes nor established national guidelines for the prevention and management. 50% of African countries reported having diabetes control plans including Kenya. The National strategic plan for eye care in Kenya 2005-2010 was developed by the Division of Ophthalmic services of the Ministry of Health in cooperation with stakeholders in the National Prevention of Blindness Working Group (NPBWG) to address eye problems. Diabetic retinopathy has been identified as a significant contributor to blindness and strategies were designed to combat it. Effective preventive strategies should be established where they do not exist and also be rationally and widely utilized. The management of diabetes needs to be monitored through implementation of national strategies for optimal control of diabetes, hypertension, dyslipidemia and obesity.

In the WHO African region, diabetes mellitus is an important public health disorder for many reasons. Not only are the risk factors associated with diabetes mellitus ever increasing, but the individual with diabetes frequently makes his or her decisions concerning the disease outside the clinical setting, either at home, on the job, or within his/her existing community. Many individuals are influenced by traditional beliefs, myths and misconception regarding the causes, symptoms and care of diabetes mellitus and continue to seek alternative measures for curing their condition. Public awareness and understanding of DM remains very low in certain areas.

There are many important issues that need to be addressed in DM care. There is a need for training of health professionals and paramedics on diabetes mellitus prevention and control.

1.2 DIABETIC RETINOPATHY

1.2.1 Definition and epidemiology

Diabetic retinopathy is composed of a characteristic group of lesions found in the retina of individuals having had diabetes for several years. It has a serious import for the affected eye in that the functional ocular sequelae may lead to various degrees of visual impairment or even involve a blind, painful eye occasionally requiring enucleation. In addition, the presence and severity of diabetic retinopathy reflects, in varying degrees, complications of diabetes in other organs. There are differences in the frequencies reported by various investigators. This may be due to differences in the study design as well as in the actual distribution of complications. However diabetic retinopathy is a common occurrence in all of them [13].

Diabetic retinopathy is a microvascular complication of both type 1 and type 2 diabetes mellitus. It is considered to be the result of vascular changes in the retinal circulation. Diabetic retinopathy exhibits features of both micro-vascular occlusion and leakage.

It develops in nearly all persons with type 1 diabetes and in more than 77% of those with type 2 who survive over 20 years with the disease. Diabetic retinopathy is a leading cause of new onset blindness in industrialized countries and a more and more frequent cause of blindness in middle-income countries [14]. WHO has estimated that DR is responsible for 4.8% of the 37 million cases of blindness throughout the world [14]. DR accounts for 5-10% blindness in the intermediate economies [14].

PDR affects 5-10% of the diabetic population [15]. Type 1 diabetics are at a particular risk with an incidence of about 60% after 30 years. Protective factors for PDR include carotid occlusive disease, posterior vitreous separation, high myopia and optic atrophy [15].

If all diabetics with proliferative retinopathy had received timely evaluation and treatment, the rate of blindness (let alone severe visual loss) could have been reduced from 50% to less than 5% after 5 years, a greater than 90% reduction in blindness from this disease. [16]

Several studies conducted in Africa have demonstrated that diabetic retinopathy is a major cause of blindness among diabetics as illustrated by selected references below: Nabatanzi et al found the prevalence of DR to be 35.2% in Uganda [17] and Seyoum et al found a prevalence of 37.8% in Ethiopia [18]. Kariuki et al found the prevalence of DR to be 49.8% in patients attending a diabetic eye clinic at KNH, Kenya. 82% of the patients had no previous eye examination and 48.6% of DR patients needed some form of treatment. 32.5% had potentially blinding DR whereas 19.8% had blinding conditions [19]. Githeko et al found the prevalence of DR to be 18.3% whereas 49% of the patients had blinding conditions in his study at rural hospitals in central Kenya [20] Nkumbe et al found that 30.4% of newly diagnosed diabetics had DR whereas 12.5% had blinding conditions at KNH [21]. Gichuhi et al found that most patients with POAG or ocular hypertension did not show any DR [22]. Wachira et al in his study on diabetic retinopathy in pregnancy in 2006 found that there was no statistically significant difference in the prevalence levels of diabetic retinopathy between pregnant and non pregnant women in the study population [23]

1.2.2 Classification of diabetic retinopathy.

The rationale for a classification scheme is to describe the severity of retinopathy using a simple, clinically relevant scale. Scales are based on the observed course of the disease when no intervention has occurred. The Airlie House Classification has been widely used. It describes the presence and severity of the major lesions of diabetic retinopathy [24] The most commonly used classification today is a modified Airlie House Classification as introduced by the Early Treatment of Diabetic Retinopathy Study groups [24] (see appendix 6.3).

1.2.3 Risk factors

The following risk factors are associated with diabetic retinopathy [15]: duration of diabetes, glycaemic control, blood pressure, contraception and pregnancy, insulin, serum lipids, ethnicity, age at diagnosis, age, nutritional factors, cigarette smoking, alcohol, obesity, and physical activity.

Duration of diabetes is the most important risk factor. In patients diagnosed with diabetes before the age of 30 years, the incidence of DR after 10 years is 50% and after 30 years 90%. DR rarely develops within 5 years of the onset of diabetes or before puberty, but 5% of type 2 diabetics have DR at presentation.

Poor metabolic control complements duration as a major risk factor and is greatly relevant to the development and progression of DR [15].

Hypertension if poorly controlled has been associated with worsening of DR and the development of proliferative diabetic retinopathy (PDR) in both type 1 and type 2 diabetics [15].

Nephropathy if severe is associated with worsening of DR. Conversely, treatment of renal disease (e.g. renal transplantation) may be associated with improvement of retinopathy and a better response to photocoagulation [15].

Pregnancy is occasionally associated with rapid progression of DR. Predicting factors include poor control of diabetes, too rapid tightening of control during the early stages of pregnancy and the development of pre-eclampsia and fluids imbalance [15].

1.2.4 Screening for diabetic retinopathy

Since early diabetic disease is asymptomatic, screening is imperative. The abnormalities that characterize diabetic retinopathy occur in a predictable progression with minor variations in the order of their appearance. The detection of their presence and the extent of involvement of the retina require a careful examination of the retina, preferably with the dilation of the pupils. Generally, the larger the pupil, the better the view.

The minimum sensitivity for any screening method to be effective, if it is to be repeated at the recommended interval is 60%. Screening for diabetic retinopathy needs to be community-based in addition to clinic based services and can include a range of examination modalities [8].

1.2.5 Evidence base for prevention and treatment of diabetic retinopathy

Evidence- based treatment reported from clinical studies spanning more than 30 years can reduce the risk for severe vision loss and blindness from proliferative diabetic retinopathy by more than 90%. Methods are also available to reduce the risk of legal blindness and moderate vision loss significantly. Amongst others, the following selected five large multicentre clinical trials provide scientific evidence for the current clinical management of diabetic retinopathy:

Diabetic Retinopathy Study (DRS)

The diabetic retinopathy study (1971 – 1975) demonstrated conclusively that pan-retinal laser photocoagulation reduces the risk for severe vision loss due to proliferative diabetic retinopathy by as much as 60% [25]. This study also provided the first and still most widely used classification system for grading the severity of diabetic retinopathy and indication for treatment with pan-retinal laser.

Early Treatment Diabetic Retinopathy Study (ETDRS)

The Early Treatment Diabetic Retinopathy Study (1979 – 1990) demonstrated that pan-retinal laser photocoagulation can reduce the risk for severe vision loss (best corrected vision of 5/200 or worse) to less than 2%. It also showed that central laser photocoagulation can reduce the risk for moderate vision loss (a doubling of the visual angle) from diabetic macular oedema by 50%, with no significant adverse effect on the progression of diabetic retinopathy or risk for vitreous haemorrhage for patients with diabetes mellitus [25].

Diabetic Retinopathy Vitrectomy Study (DRVS)

The Diabetic Retinopathy Vitrectomy Study (1977-1987) provided insight into the timing of Pars-plana vitrectomy surgery to restore useful vision in eyes with non-resolving vitreous haemorrhage [25]. In particular, it highlighted that, in certain situations, early vitrectomy resulted in better vision. It also drew attention to a generally poor prognosis of eyes that experience vitreous haemorrhage, regardless of the timing of surgery, indicating the desirability of preventing such late complications of diabetic retinopathy.

Diabetes Control and Complications Trial (DCCT) and Epidemiology of Diabetes Interventions and Complications Trial (EDICT)

In the **Diabetes Control and Complications Trial (1983 – 1993),** conventional blood glucose control was compared with intensive blood glucose control in patients with type I diabetes mellitus and little or no diabetic retinopathy. The trial conclusively demonstrated that, for these patients, intensive control of blood glucose as reflected in measurements of glycosylated haemoglobin reduced the risk for progression of diabetic retinopathy. Those with intensive control showed a 54% reduction in the development of a three-step progression of diabetic

retinopathy, a 47% reduction in the development of severe non-proliferative or proliferative diabetic retinopathy, a 56% reduction in the rate of laser surgery and a 23% reduction in the risk for macular oedema [25 – 27]. Seven years after completion of the DCCT, the **Epidemiology of Diabetes Interventions and Complications Trial** showed that persons in the intensive control group continued to have a substantially lower risk for progression of retinopathy than the conventional control group, despite near convergence of glycosylated levels [27]. These studies are notable for two additional findings. First, there is no threshold below which diabetic retinopathy does not occur when glycosylated haemoglobin is elevated; rather, there is a linear relationship between achieved glycosylated haemoglobin level and the risk of visual complications of diabetes. Secondly, persons receiving intensive control had a significant rate of hypoglycaemic reactions, which might argue against aggressive control in every situation. The choice of 'target' glycosylated haemoglobin level is therefore arbitrary, involving consideration of the benefits and costs for each patient and thus for society.

United Kingdom Prospective Diabetes Study (UKPDS)

The findings of the UKPDS (1977-1999) were similar to those of the DCCT for persons with type 2 diabetes mellitus [28, 29]. In addition, it highlighted the independent role of systemic hypertension (or its control) in potentiating the development and worsening of the progression of diabetic retinopathy. Furthermore, like the DCCT, it demonstrated the negative effects of elevated cholesterol and serum lipids concentrations on the risk for retinal complications in patients with diabetes mellitus.

1.2.6 Principles in eye care for patients with diabetes

Despite clearly defined clinical standards for evaluating and treating diabetic retinopathy cost effectively, for a variety of reasons (see below), effective treatments such as laser surgery are often underused.

It has been estimated that 50% of adults with diabetes mellitus in the United States do not receive the recommended eye care that would allow timely diagnosis and treatment of diabetic retinopathy [30, 31]. Studies have also shown that many persons who require sight-preserving laser surgery do not receive it [32,33]. These patients tend to be older; less educated and have had a more

recent diagnosis than those receiving regular eye care. They are also likely to live in rural areas and receive health care from a family or general practitioner. Alarmingly, 32% of patients with diabetes mellitus at high risk for vision loss never undergo an eye examination and less than 40% of those with high risk characteristics for vision loss receive treatment [34, 35]. When examined, almost 61% of these patients are found to have diabetic retinopathy, cataract, glaucoma or another ocular manifestation related to diabetes mellitus [36].

These findings have significant implication for the person and for society. It has been estimated that programmes to identify and treat diabetic retinopathy would have saved the United States health care budget nearly US $ 400 million annually in the early 1990s [37], a figure that would probably be substantially higher today. The total annual cost of diabetic eye disease in the United States at that time was about US $ 2.8 billion, 75% of which was for persons who received treatment that was not proven to be effective [37]. Even persons who are older at the onset of non-insulin dependent diabetes can significantly benefit in years of sight saved by use of mydriatic fundus photography for screening [38]

In order to prevent vision loss due to diabetic retinopathy, diabetic health care and eye care delivery systems in every society should be improved. While specific resources and methods differ widely from country to country, certain basic aspects of care must be delivered in all countries. By focusing on the patient and using common principles a unified approach can be created, with respect for the resources and culture of each society, for best delivering eye care to patients with diabetes mellitus. The following basic components of care must be present [39]:

Patients should know that they have diabetes mellitus and that the condition requires care. General population screening for diabetes mellitus with existing methods is considered neither appropriate nor beneficial, although use of such methods to reach sub-populations with a very high prevalence of diabetes mellitus might be both appropriate and feasible for some WHO member states.

Patients should receive adequate care for diabetes mellitus. The only means of preventing major complications from diabetic retinopathy is regulating blood sugar, blood pressure and other risk factors that can be controlled by patients, under the guidance of their care provider.

Often, however, physicians do not care for diabetes patients in the manner indicated by the results of randomized controlled trials.

Patients should undergo periodic eye examinations. Professional organizations advocate annual eye examinations for patients with diabetes and prompt treatment when indicated. Nevertheless, many patients with diabetes are not evaluated or treated adequately to prevent unnecessary blindness and visual loss.

Patients should receive adequate treatment for diabetic retinopathy. The prevention of vision loss from diabetic retinopathy should be an integral part of the management of diabetes mellitus. Specific treatment for sight-threatening stages of retinopathy should follow established guidelines.

Patients should be sufficiently aware and motivated to undergo not only an initial eye exam but also regular follow-up examinations. Understanding the difficulties and barriers to regular eye examination is one step in addressing the prevention of blindness from diabetic retinopathy. It is not enough to provide information those patients can understand; a 'marketing' approach should be used, to 'sell' the patient the idea of the importance of regular eye examinations.

1.2.7 Principles for organizing an eye health system for the care of diabetic retinopathy

The following principles for organizing eye health systems for diabetic retinopathy care must be considered [39]:

Accuracy of examination results:

If diabetic retinopathy is suspected or established after screening, a decision must be made about the overall management for a given level of diabetic retinopathy. In many developing countries, there are too few persons to provide even basic eye care to the population, let alone specialized eye care for patients with diabetes and related blindness prevention. Involving non-ophthalmic health care providers in various aspects of eye care for patients with diabetes is a viable alternative.

Use of specific photographic systems with expert interpretation could increase the ability of primary care providers to detect diabetic retinopathy, and it has been shown that the evaluations of trained readers of photographs can match or exceed those of physicians and optometrists. The advent of digital photography and high-speed internet connections has made use of electronic

images feasible where available, although issues associated with image compression are yet to be resolved.

It is recommended that the International Clinical Classification of Diabetic Retinopathy, which provides a sound scientific basis for a uniform grading system, be used as an acceptable minimum standard for assessing diabetic retinopathy in programmes for prevention of blindness. This system provides a simplified but sound scientific basis for uniform grading by general ophthalmologists who have a basic understanding of diabetic retinopathy and skills in evaluating the retina. It has been adopted by the International Council of Ophthalmology and by many Member societies.

Locations for detection and treatment of diabetic retinopathy:

DM and DR are usually detected and treated at health care facilities ranging from private offices to hospital – based facilities. Alternative sites for providing care might be mobile health vans or health care services, which move to or take up fixed locations near patients homes. Another alternative is mass community examinations or screening, in which large numbers of patients are seen in a co-coordinated fashion by teams of providers and associated personnel.

It is recommended that the International Clinical Classification of Diabetic Retinopathy be used for determining the threshold for referral to treatment centres.

The threshold for referral for eye care can vary but should include sight -threatening retinopathy. (Proliferative retinopathy or macular oedema). Member states might decide to use a lower threshold for treatment, such as moderate to severe non proliferative retinopathy.

Appropriate follow-up intervals:

Significant problems have been encountered in ensuring regular follow-up of patients with diabetic retinopathy. Higher rates of follow-up have, however, been reported with the use of vans and trained photographic readers using reference standard photographs to provide immediate feedback to patients. Approaches addressing patient convenience, access and feedback, might serve as model for a 'marketing' approach for patient- centred detection and management of eye disease associated with diabetes.

2.0 RATIONALE

Diabetic retinopathy is an important public health problem and a significant cause of visual loss and blindness. The magnitude of diabetic retinopathy is expected to rise dramatically in Kenya. The implications of diabetic retinopathy to patients, their families, the health care system and Governments is enormous. The type of services and resources required for comprehensive diabetes mellitus and diabetic retinopathy care are known. However, these services may be unavailable, inadequate, inappropriately distributed or poorly utilized.

3.0 JUSTIFICATION

No study has been done in Kenya to establish diabetic retinopathy services capacity (personnel, infrastructure, equipment and supplies), services delivery, utilization, referral and linkages.

The findings of this study will assist planners, health providers and other stakeholders e.g. National Prevention of Blindness Working Group (NPBWG) with relevant data to plan for the Kenya Ophthalmic Programme (KOP). The NPBWG is an advisory body to the Division of Ophthalmic Services of the Ministry of Health in Kenya and other stake holders in eye care. The data would help the KOP develop appropriate strategies and services to assist diabetics and the public in Kenya as the diabetes mellitus epidemic develops.

4.0 OBJECTIVES

4.1 Broad objective

To determine the situation of diabetic retinopathy services in Kenya.

4.2 Specific objectives

1. To identify health care providers involved in:
    a) Diabetes mellitus care;
    b) Diabetic eye care and specifically diabetic retinopathy care.

2. To identify the type of diabetic retinopathy services currently offered by health care facilities.
    2.1 To identify modes of screening for diabetic retinopathy:
        a) What methods are used for screening for diabetic retinopathy?
        b) Who is involved in screening for diabetic retinopathy?
        c) At which locations is screening for diabetic retinopathy done?
    2.2 To identify key resources utilized in the management of diabetic retinopathy:
        a) Human resources;
        b) Equipment.

5.0 METHODOLOGY

5.1 Study design

Cross-sectional hospital based study

5.2 Study area

Republic of Kenya

5.3 Study population

All District Hospitals, Provincial General Hospitals, National Teaching and Referral Hospitals and all eye units in Kenya.

5.4 Study setting

Eye clinics and medical outpatient clinics.

5.5 Study period

The study period was five months from May to October 2008.

5.6 Justification of sampling procedure

No sampling was done in this study. The presence and distribution of currently available diabetic retinopathy services needs to be determined in order to identify and bridge any gap. The study therefore was conducted in all district, provincial and teaching and referral hospitals and all eye units in the country. A small pilot study conducted in thirty facilities across the country confirmed the feasibility of this study. The Ministry of Health's Sector Wide Approach (SWA) in service delivery states that all health service providers and facilities (public, voluntary and private) have a complementary role. The contribution of both, private and public health care providers also needs to be recognized and put into consideration when planning for services. The District Hospital is the unit of planning for medical services in Kenya. Through key informant interviews, currently available services and providers relevant for diabetic and diabetic eye care with a focus on diabetic retinopathy care was obtained. Provincial Eye Surgeons (PES) and Zonal Eye Surgeons (ZES) provided further information on their administrative areas.

Secondary data from the Division of Ophthalmic Services and the Ministry Of Health assisted in identifying all hospitals and eye units, crosschecking information and filling any information gap left. This multi-method approach (triangulation) of data collection helped to boost response rates and enhanced the reliability of data.

5.7 Inclusion and exclusion criteria

Inclusion criteria:

- All district, provincial, teaching and referral hospitals;
- All eye units;
- All health facilities offering DM / DM Eye care services identified by key-informants as relevant in the context of the study.

Exclusion criteria:

- Private eye clinics and medical clinics for logistical reasons.

5.8 Data collection and management

5.8.1 Data collection

A list of all district, provincial, teaching and referral hospitals and all eye units in the study area was obtained from the MOH / DOS with addresses, telephone numbers, email contacts and contact persons. Questionnaires, ethical approval and covering letters were sent to all institutions identified via email, post or courier services as applicable. Data was collected using a field tested (pilot study) semi-structured questionnaire. Telephone calls were made to all facilities requesting consent for the interviews. The interviewees were requested to assist in the completion of the questionnaire via telephone interview or to complete and send questionnaires to principal investigator through the address provided. The telephone interviews were conducted and questionnaires completed by the investigator. The Heads of each health facility or a technical person in charge of MOPC and/or the eye clinic identified by the Head of the institution were interviewed as key informants. The Provincial Eye Surgeon (PES) and Zonal Eye Surgeon (ZES) provided further information on their respective administrative areas. Any major service provider identified by a key informant was included. All questionnaires filled were cross-checked for any erroneous or missing data. Secondary data was obtained from the DOS / MOH and compared

with data from the questionnaire. Follow up telephone calls were made to complete any missing, correct any erroneous data or clarify any discrepancies.

5.8.2 Data management and editing

The data was transferred into Excel file. Data entry was done twice at different times. Both data sheets were subsequently checked for alterations (by subtraction of values). Whenever there was an alteration found in any of the data sheets, the value was again checked with the original paper sheet and accordingly corrected.

5.8.3 Data consistency and validity

Through range checks the data entry software ensures to a large extent that there were no inconsistencies or invalid data. However the data free of entry errors was again checked for consistency.

5.8.4 Data storage

The data was stored on a hard disk and security copies were made weekly on a flash disk.

5.8.5 Data analysis

Qualitative data was analyzed and processed using SPSS version 13.0 statistical software.

5.9 Materials and services

a) Flash disk for data storage;
b) Calculator;
c) Stationery;
d) Telephone services;
e) Mailing services.

5.10 Ethical considerations

Ethical approval was sought and obtained from the Kenyatta National Hospital Ethics and Research Committee (KNH ERC). Approval for the study was also obtained from the Ministry of Health. Consent for the study was also obtained from all health facilities included during the

interview using the consent form attached (see appendix 12.1). Strict confidentiality of all records was observed throughout the study and all data was stored at a secured place. Results of the study will be communicated to stakeholders involved.

6.0 RESULTS

A total of 80 facilities were reviewed. Seventy (87.5%) were public facilities whereas voluntary facilities were 10 (12.5%).

Table 1: Facilities Coverage

Type	Frequency	Percentage
DH	57/71	80.3
TRH	2/2	100.0
PGH	7/7	100.0
Eye Units	80/80	100.0

All eye units, Provincial General Hospitals, Teaching and Referral Hospitals were covered whereas 57 (80.3 %) of all District Hospitals in Kenya were covered.

Table 2: Category of Eye Health Facility

Category	Frequency	Percentage
• District Hospital	58	72.5
• Other	8	8.8
• Provincial Hospital	7	8.8
• Eye Hospital	4	6.2
• Teaching & Referral Hospital	3	3.8
TOTAL	**80**	**100.0**

72.5% of eye clinics were within district hospitals .Others included: Kenya Society for the Blind (KSB), Sight by Wings (SBW), Armed Forces Memorial Hospital (AFMH), Tenwek, Litein, Kikuyu Eye Unit (KEU), Bandari and Chogoria.

Eye Hospital Includes: - Lions Sight First Hospital - Loresho, Pwani Lions eye centre, Sabatia eye hospital and Light House for Christ eye centre.

Kenyatta National Hospital and University Of Nairobi eye clinics are considered as two clinics under teaching and referral hospitals but they operate under one roof.

Table 3: Facilities Distribution per Province

Province	Total	TRH	PGH	DH	Eye Hospital	Other
Rift -Valley	23 (28.8%)	1	1	19	0	2
Coast	14 (17.5%)	0	1	10	2	1
Eastern	12 (15.0%)	0	1	10	0	1
Central	9 (11.3%)	0	1	7	0	1
Nairobi	7 (8.8%)	2	0	1	1	3
Western	6 (7.5%)	0	1	4	1	0
Nyanza	5 (6.3%)	0	1	4	0	0
North -Eastern	4 (5.0%)	0	1	3	0	0
TOTAL	**80 (100.0%)**	**3**	**7**	**58**	**4**	**8**

Rift-Valley, Coast, Eastern and Central provinces have 58 (72.5%) of the facilities leaving half of all provinces with 22 (27.5%).

Table 4: Key Informants on DM Services

Category	Frequency	Percentage
• Physician	11	13.8
• General Practitioner	18	22.5
• CO	43	53.8
• Other	8	10.0
TOTAL	**80**	**100.0**

The key informants on diabetes mellitus services were mainly clinical officers and general practitioners 61 (76.3%).

Table 5: Key Informants on Ophthalmic Services

Category	Frequency	Percentage
• Ophthalmologist	13	16.2
• OCO/CS	49	61.2
• ON	11	13.8
• Other	7	8.8
TOTAL	**80**	**100.0**

The key informants on ophthalmic services were mainly ophthalmologists and ophthalmic clinical officers (77.4%).

Table 6: Availability of Special Clinics for DM and / or DR

Type of Clinic	Frequency	Percentage
• MOPC	74	92.5
• DM	36	45.0
• Eye	73	91.2
• DR	3	3.8
TOTAL	**80**	**100.0**

Most of the facilities 74 (92.5%) have medical out -patient clinics but only 36 (45.0%) have dedicated diabetic clinics. Kikuyu Eye Unit and Kenyatta National Hospital / University Of Nairobi have diabetic retinopathy clinics.

Table 7: Distribution of Medical Patients

Province	General	DM	Referrals
Rift -Valley	**273,048 (30.7)**	13,385 (18.8)	3,595 (26.9)
Central	164,200 (18.5)	12,494 (17.6)	**4,290 (34.3)**
Nairobi	161,284 (18.2)	**17,454 (24.5)**	4,874 (27.9)
Coast	144,543 (16.3)	12,920 (18.1)	4,025 (31.2)
Eastern	61,740 (6.9)	5,486 (7.7)	1,812 (33.0)
Nyanza	43,800 (4.9)	5,910 (8.3)	**930 (15.7)**
Western	31,300 (3.5)	2,480 (3.5)	630 (25.4)
North-Eastern	**8,600 (1.0)**	**1,060 (1.5)**	320 (30.2)
TOTAL	**888,515 (100.0)**	**71,189 (8.0)**	**20,476 (28.8)**

Rift-Valley province had the highest number of medical out -patients 273,048 (30.7%); whereas North- Eastern province had the least 8,600 (1.0%). Diabetics constitute about 8.0 % of all medical out –patients in Kenya. Nairobi had the highest number of diabetics at 17,454 (24.5%) and North- Eastern province the lowest at 1,060 (1.5%). Seventy- nine per cent (79.0%) of known diabetics are in Rift-Valley, Central, Nairobi and Coast provinces. About 28.8 % of all diabetics are referred to eye care specialists for screening for diabetic retinopathy. Central province had the highest percentage (34.3 %) of diabetics referred to eye care specialists for evaluation whereas Nyanza had the least (15.7 %).

Table 8: Distribution of Eye Patients

Province	General	Percent	DM	Percent	DR	Percent
Central	106,926	**21.1**	9,660	**9.0**	956	9.9
Rift -Valley	104,150	20.5	3,017	**2.9**	567	18.8
Coast	87,363	17.2	6,922	7.9	1,636	23.6
Nairobi	80,084	15.8	6,794	8.5	2,715	**40.0**
Western	56,353	11.1	3,200	5.7	385	12.0
Eastern	40,237	7.9	1,848	4.6	403	21.8
Nyanza	24,500	4.8	1,180	4.8	140	11.9
North -Eastern	7,700	**1.5**	240	3.1	22	**9.2**
Total	**507,313**	100.0	**32,861**	6.5	**6,824**	20.8

Central, Rift-Valley, Coast and Nairobi Provinces had 74.6 % of all eye Patients. Diabetics account for 6.5% all eye Patients. Central Province had the highest proportion of diabetics 9,660 (9.0%) whereas Rift-Valley had the least at 3,017 (2.9%). About 20.8% of all diabetics had diabetic retinopathy .Nairobi was found to have the highest prevalence of diabetic retinopathy of 40.0% while North-Eastern had a prevalence of 9.2%. The median National prevalence of diabetic retinopathy is 15.4%. The number of diabetics seen in the eye clinics is higher than the number referred from Medical out- patient clinics.

Table 9: Screening at MOPC

Screening	Frequency	Percentage
• DM eye disease	45	56.2
• DR	45	56.2

Clinicians at medical out- patient clinics routinely either made an attempt to screen for diabetic retinopathy themselves or referred Patients to eye clinics in 45 (56.2%) facilities.

Table 10: Personnel involved in Screening for DR at MOPC

Person	Frequency
• Eye Worker	45
• Physician	18
• General practitioner	16
• Diabetologist	3

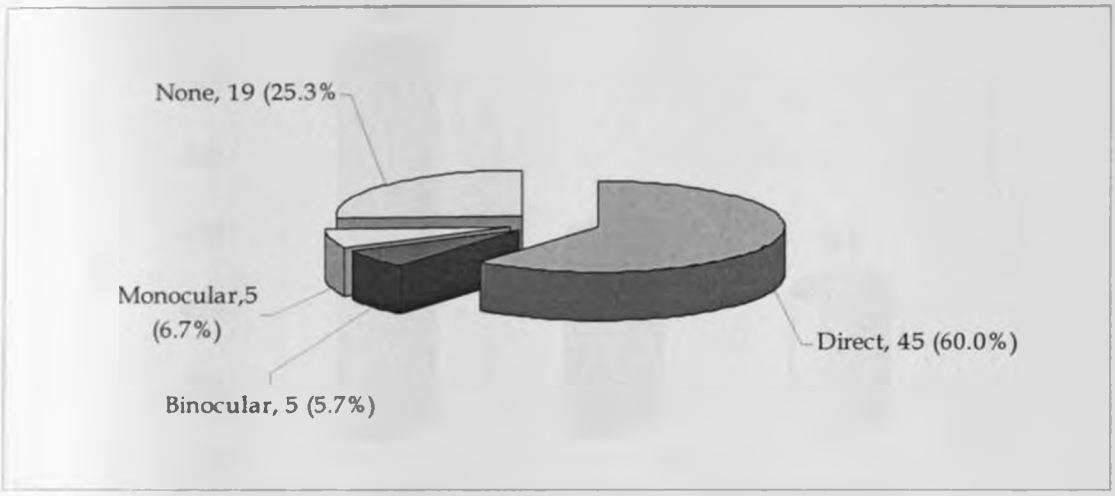
A combination of clinicians was involved in screening for diabetic retinopathy. Most DR screenings at MOPC were done by eye workers. Physicians and General practitioners were the main non-ophthalmic clinicians involved.

Table 11: Personnel involved in Screening for DR at Eye Clinic

Personnel Screening for DR	Frequency
• Ophthalmic Clinical Officers (OCO)	68
• Ophthalmologist	30
• Non-Ophthalmic workers	21
• Other (Ophthalmic Nurses, Optician)	11
• Optometrist	4

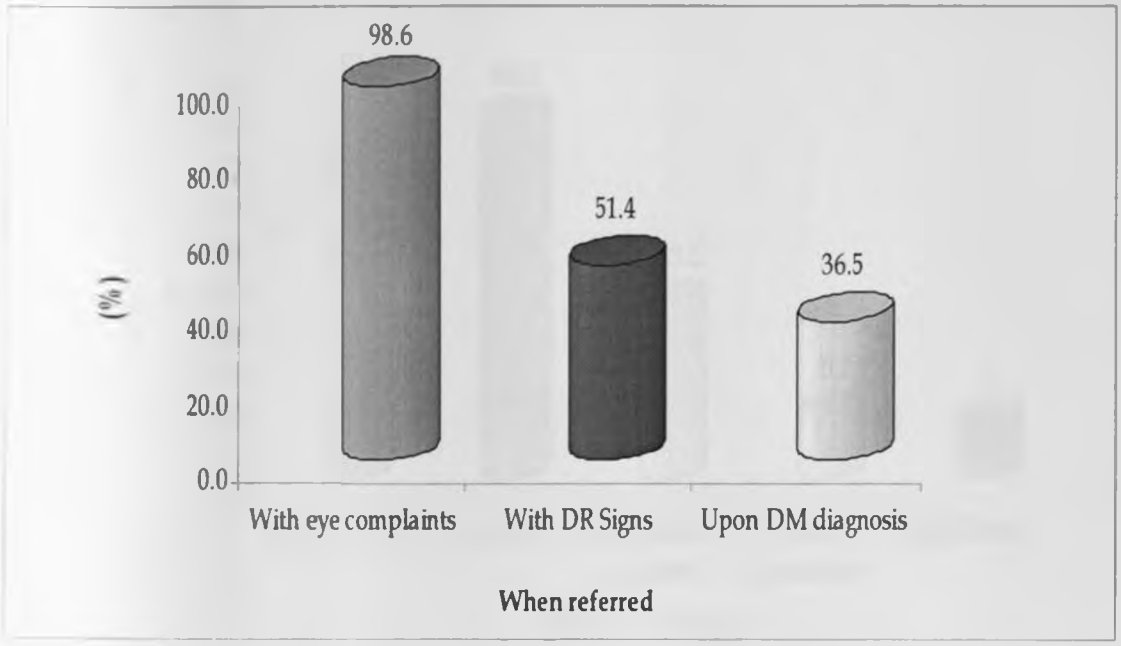
Ophthalmologists and Ophthalmic Clinical Officers (OCO) were the main clinicians screening for diabetic retinopathy at eye units. It is noteworthy that Optometrists and Ophthalmic Nurses participated in screening for diabetic retinopathy.

Figure 1: Screening Methods for DR



Direct ophthalmoscopy is the most commonly used method 45 (60%) of screening for diabetic retinopathy in both medical out- patient clinics as well as in eye units. Indirect ophthalmoscopy is only employed in eye units with the necessary equipment and trained personnel. Both monocular and binocular indirect ophthalmoscopy is performed at the same frequency 5 (6.7%). Slit lamp bio-microscopy with condensing lenses is also used where available and trained clinicians are working.

Figure 2: Indications for DR – Screening referral



Clinicians in the medical out patient clinics referred patients to eye care specialists when they had eye complains in 98.6% of cases , with DR signs in 51.4% and upon diagnosis of DM in 36.5%.

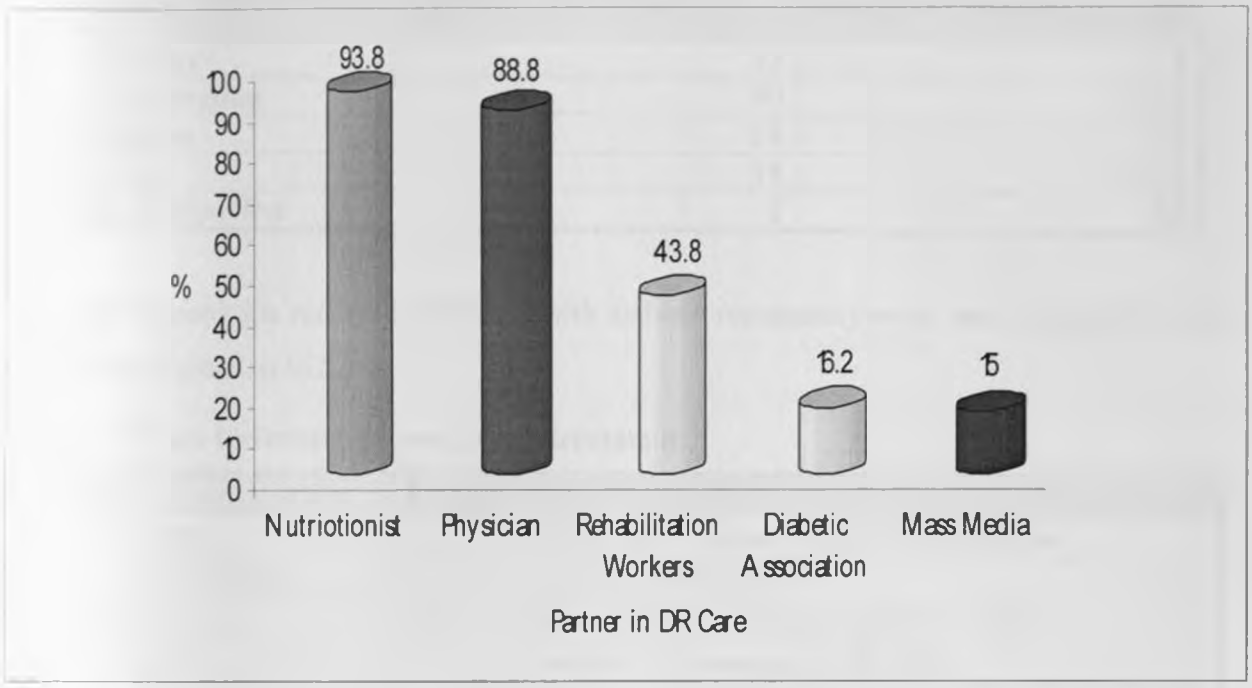
Health facility based screening was done in 76 (95%) of the facilities and community based screening was only performed by 8 facilities (10%).

Table 12: DR Services offered

Service	Frequency	Percentage
• Patient education	75	93.8
• Screening	74	92.5
• Training of eye workers	24	30.0
• Laser surgery	8	10.0
• VR surgery	5	6.2
• Rehabilitation	2	2.5

Most facilities (93 %) offered diabetic retinopathy services, mainly as patient education and screening. Laser was performed in 8 (10.0%) facilities whereas vitreo-retinal surgery was offered in 5 (6.2%).

Figure 3: Partners in DR Management



Eye care specialists partner mainly with physicians (88.8%) and nutritionists (93.8%) in the care of diabetics, besides mass media, rehabilitation workers and diabetic associations.

Table 13: Indications for DR referral by DR grade

Grade	Frequency	Percent
PDR	75	93.8
CSME	69	86.2
ALL Grade	47	58.8
NPDR	45	56.2

Eye care specialists recognized PDR (93.8%) and CSME (86.2%) as the main indications for DR referral. However, screening for diabetic retinopathy 58.8% of facilities reported that they would refer all grades of diabetic retinopathy.

Table 14: Indication for DR referral by management procedure

Reason	Frequency	Percent
Laser Therapy	53	66.2
Further Evaluation	50	62.5
Rehabilitation	14	17.5
VR Surgery	14	17.5
Intravitreal injection	2	2.5

The main reasons for referral of Patients with diabetic retinopathy were laser therapy (66.2%) and further evaluation (62.5%).

Table 15: Main Referral Centres for DR treatment

Province	Main Referrals centres
• Nairobi	KNH, KEU, Lions, Aga Khan, Nairobi
• North -Eastern	Garrisa, KNH, KEU
• Eastern	Embu, Meru, Machakos, KNH, KEU
• Western	Sabatia, Kakamega, KNH, KEU
• Nyanza	Kisumu, KNH, KEU
• Coast	Kwale, Coast, Light House, KNH, KEU, Moshi
• Rift -Valley	MTRH, Nakuru, Tenwek, KNH, KEU
• Central	Nyeri, KNH, KEU

Eight (8) facilities offer specialised DR treatment in Kenya. These are UON/KNH, Light House, Lions-Loresho, Pwani Lions, Kwale DEC, Kikuyu, Sabatia and Tenwek. Amongst these, KNH/UON and KEU are the main referral centres for DR treatment. Moshi in Tanzania is also a referral centre for patients from coast province.

Personnel Trained to treat DR are found in 13 (16.2%) units and they are mainly general ophthalmologists who accounted for 22 (27.5%) of the key informants and 4 VR surgeons (5.0%). All ophthalmologists who qualified from The University of Nairobi since 1996 are trained to indicate and perform laser photocoagulation. However, only eight Units currently offer laser treatment due to lack of equipment. Vitreo-retinal surgery is only performed at KNH, KEU and Tenwek.

1. DISCUSSION

By the time of the research, Kenya was divided into eight administrative provinces, which were further divided into 73 districts (UN, 2005). Since then, the Government has gazetted 73 new districts. The process of establishing these new districts is on going [40]. The study reviewed 57 of the old 73 districts (coverage 80.3%). Non-coverage of the 16 remaining Districts was due to non-response from key informants despite numerous attempts to collect data. All eye units recognized by the Division of Ophthalmic Services were however covered (coverage 100%). With the creation of new districts, it is anticipated that much needed health services would be brought closer to the people. The challenge however, is that even the currently available facilities are neither sufficiently staffed nor equipped to handle the ever increasing patient numbers and changing disease pattern. Most old districts have a district hospital with an eye unit whereas most of the recently created new districts will have to upgrade health centres and sub district hospitals to new district hospitals.

Kenya covers an area of 582,646 square kilometres [41] for an estimated population of 37.9 million with a population growth rate of 1.2% per annum (June 2007 estimate). Forty six percent of the population is aged 0-15, whereas 51% is between 16 and 64 years. Currently, only 3% of the population is above 65 years of age and sixty- six (66%) percent of the population live in rural areas as opposed to 34% urban population [51]. However, population increase, ageing and rapid urbanisation all suggest a dramatic increase in the burden of non-communicable diseases such as DM. This implies that more people will need eye care and specifically DR services.

The Ministry of Health is charged with ensuring good health to all Kenyans guided by a Kenyan Health Policy Framework produced in 1994 [42]. The Technical arm of the Ministry is headed by the Director of Medical Services assisted by Departmental Heads. There are six departments, which are further divided into Divisions. At the Provincial level, health services are co-coordinated by the Provincial Medical Officer assisted by a team of technical officers. The District Medical Officer of Health co-ordinates services at the district level with the support of technical staff. The District is the implementation unit with roots to health centres and dispensaries, which have, direct link with the communities. The Office of the President, Ministry

of Finance, Ministry of Education, Science and Technology and Ministry of Gender and Culture all have significant influence in the implementation of health policy in the country.

The Kenyan health care delivery system is an expansive system comprising more than 3500 health facilities operated by Government, NGO, Mission and private facilities [42]. The public sector comprises health facilities under Ministry of Health, Ministry of Local Government, Parastatals and other Government Ministries. The public sector is the major provider of health services and has 58% of all health facilities and 70% of all health personnel. Voluntary sector consists of Mission Health Services and NGO run health facilities. Private sector medical services are provided directly by private health facilities and health professionals in private practice (private for profit sector).Traditional medicine includes herbalists, bonesetters and spiritual healers. In this study, only the public and voluntary health service providers were included. Private for profit health service providers were excluded for logistical reasons, although it is recognized that they also play a role in diabetes mellitus and diabetic retinopathy care.

The structure of the Government health services is hierarchical as shown in appendix 12.7. The current establishment of the health service providers is as outlined in appendix 12.8. Despite the large number of medical facilities, service delivery is still a far cry from ideal. This is largely due to inadequate staffing and equipment. Collaboration between physicians and eye care providers in managing diabetes was noted in most of the facilities. This needs to be encouraged and further boosted through regular multi-disciplinary continuous medical education. Currently, communicable diseases are the greatest cause of morbidity and mortality in Kenya. Eye diseases account for 2.0%, and are ranked eighth among the top ten causes of morbidity. The prevalence of blindness in Kenya is estimated as 0.7% [42]. Over 80% of the causes of blindness are due to curable and preventable causes. Diabetic retinopathy may be responsible for 3.0% of blindness [42].

The Division of Ophthalmic Services in the Department of Preventive and Promotive Services is charged with the co-ordination of eye care services in Kenya carried out by different actors. The current number of eye care workers delivering eye care services in both public and private sector

is as shown in appendix 12.9 (a) [42]. Human resource development (HRD) has to be integrated into the comprehensive development of strengthening of efficient and cost-effective eye care services. The numbers required to be trained by the year 2010 to respond to the current gap are as shown in appendix 12.9(b) [42].

The UON and KMTC have continued to play a significant role of training eye care workers. The UON has the capacity to train 10 ophthalmologists per year and KMTC can train 10 OCO/CS and 16 ON per year. The eye workers trained are Kenyans as well as non-Kenyans. Although the existing numbers are inadequate as evidenced by a ratio of, 1:550,000 compared to WHO's recommendation of 1:250,000, unequal distributions of available resources is the major challenge, as 62% of the 58 ophthalmologists are based in Nairobi [42]. This leaves the rural majority with limited access to eye care services.

In this study, 72.5% of the facilities were in Rift –valley, Eastern, Coast and Central provinces. Most of the diabetics (76.3%) are managed by general practitioners and clinical officers, whose knowledge on diabetes and diabetic eye disease may be limited. The study revealed that only 50% of the facilities and care givers followed standard management guidelines for diabetes mellitus and diabetic retinopathy. It is recommended that the International Clinical Classification of Diabetic Retinopathy, which provides a sound scientific basis for a uniform grading system, be used as an acceptable minimum standard for assessing diabetic retinopathy in programmes for prevention of blindness Therefore, the curriculum of both, medical students, clinical officers, nurses including ophthalmic nurses should stress the importance of diabetes care. Training of general practitioners and clinical officers on ophthalmoscopy and provision of direct ophthalmoscopes would go a long way in early detection of diabetic retinopathy. Posting of physicians to the district hospitals would enhance diabetes care. Only 45% of the facilities studied had diabetes mellitus clinics. In view of the large number of diabetics seen, more dedicated diabetes mellitus clinics/centres need to be established where integrated or comprehensive diabetes care can be given. Key partners such as nutritionists and diabetes mellitus patient support groups should be encouraged and strengthened. Ophthalmologists and OCO/CS are the main eye care providers. All Ophthalmologists are trained to use both direct

ophthalmoscopes and indirect ophthalmoscopes including slit lamp biomicroscopy. Most of the OCO/CS who recently qualified (last ten years) are trained to use slit lamp for biomicroscopy. Slit lamp biomicroscopy was however performed only at institutions where they were available.

Most of the screening for diabetic retinopathy was facility-based as opposed to community based. This was probably because it was convenient to perform direct-ophthalmoscopy in the clinic. Community outreach medical eye camps target the major blinding diseases. General population screening is not recommended in Kenya as the prevalence is low. Portable slit lamps are also not available in most facilities, although they are not the best for DR screening. Retinal photographic techniques of screening for diabetic retinopathy are not in use in Kenya probably because of the cost of fundus camera and training manpower (Technicians).In addition, you need the technical infrastructure and preferably a minimum population density supported by a good referral system .The burden of diabetic retinopathy in Kenya does not justify this investment now.

The main diabetic retinopathy services offered include: Health education, screening, training, laser surgery, VR surgery, and rehabilitation.

Health education is performed in 93.3% of all the facilities. Through health education, the importance of periodic eye exams will be emphasized and patients would be motivated to undergo initial and follow up exams. Appropriate follow up intervals should be designed and tailored to patient convenience and access. There is need to develop standardised educational material adapted to local language and needs. The DOS / NPBC are currently developing these but needs to be implemented.

Eight facilities in Kenya have the necessary equipment for laser photocoagulation. Six of these facilities are located in Nairobi and Coast Provinces. All Ophthalmologists are now trained on laser but many institutions do not have laser. The NPBC proposed a model of one laser for one million populations through the coordinated effort by GOK and NGOs to proactively develop the infrastructure. They also proposed one VR centre for ten million populations.

Vitreo-retinal surgical services are offered at KNH/UON and KEU. Patients from Coast province often go to Moshi in Tanzania for Vitreo-retinal surgical services.

Diabetics with sight threatening lesions are referred mainly to KEU and KNH/UON. However, patients in the far flung districts with sight threatening lesions may develop irreversible blindness due to inaccessibility of these services. The threshold for referral of diabetic retinopathy is HR-PDR and CSME. In view of the limited laser and VR services currently available, using a lower threshold for treatment in PDR or even severe NPDR in remote centres and situations with poor follow up may be considered.

The Department of Preventive and Promotive Services has an active PHC division that recognizes eye care as a crucial component at the primary level of health service delivery. The PEC project at the DOS co-ordinates all primary eye care activities and ensures the integration into PHC at all levels of eye care delivery. There is an active National Prevention of Blindness Committee (NPBC) with representatives from all major stakeholders. The NPBC has been mandated with the crucial task of developing policies, ensuring their implementation as well as advocacy at National and International levels on matters pertaining to eye care.

The DOS has developed a National strategic plan for eye care in Kenya in line with the Health Sector Strategic Plan (NHSSP 11) for the period 2005-2010 [42]. This harmonization is seen to be of great significance in the eye health sector, as it will facilitate greater recognition and allocation of resources from the Ministry's budget.

The Vision 2020 "The right to sight" initiative which emphasizes partnership of the Public, Civil and Private sector led to the formation of an active National Prevention of Blindness Working Group (NPBWG) in Kenya. The priority in Kenya is to control the following major blinding diseases/ conditions: Cataract, Trachoma, Glaucoma, Childhood blindness in addition to refractive errors and low vision. Currently DR was added to this list of blinding diseases in Kenya.

In order to adequately respond to these blinding diseases, human resource, infrastructure and equipment have been integrated as key ingredients of NHSSP for eye care. Lack of adequate

facilities, ophthalmic equipment and inadequate supply of consumables has been a major hindrance in implementation of eye care programmes in Kenya. The problems are further compounded by lack of programmes of preventive maintenance, service and repairs. The DOS intends to develop a Central Ophthalmic Maintenance Unit by 2009 and gradually avails appropriate and cost effective equipment, consumables and devices to eye care delivery units by 2010 [42].

Whereas the co-ordination of eye services by the DOS is well articulated at the National level, this is not the case at the provincial and District levels. The DOS intends to strengthen these committees in its eye care plan and to integrate them into, and operate within the existing MOH structure. The DOS through effective co-ordination of activities of all partners in eye delivery in the country will minimize duplication and mal-distribution of resources, promote information sharing and provide feedback to all partners.

Primary eye care units should develop Information, Education and Communication (IEC) materials with support from partners on management of DR. The ICO guidelines on DR could be distributed and adopted. DR was included in the reporting tool of monthly ocular morbidity for DOS from the year 2008 .Through integration of PEC into PHC, the Districts will own and implement their own eye care plans with supplements from partners and donors.

Research plays an important role in planning, prioritizing and coming up with appropriate decisions for program implementation. The University of Nairobi and the Division of Ophthalmic services are actively involved in eye health research with support from development

8.0 CONCLUSIONS

- There is a skewed distribution of facilities and services for management of diabetes mellitus and diabetic retinopathy.
- Most of the diabetic retinopathy services are facility-based rather than community based.
- Most facilities offer some kind of diabetic retinopathy services, mainly patient education and screening that is not standardised and professionally adjusted to local situation.
- Screening for diabetic retinopathy is done mainly by ophthalmologists and ophthalmic clinical officers by dilated direct ophthalmoscopy which is not sensitive to detect sight threatening CSME early enough.
- There is an established referral system for patients with eye disease mainly to KNH/UON, Kikuyu eye unit and Moshi.
- Most (98.6%) clinicians refer patients for diabetic retinopathy screening when they have eye complains which may be too late to reverse visual loss or stabilize the vision.
- Most facilities lack standard management guidelines for diabetic retinopathy making uniformity in assessment, treatment and referral difficult.
- Trained personnel to manage diabetic retinopathy are few whereas DR treatment centres are concentrated in major towns, and therefore inaccessible to many patients in remote districts.
- Diabetes mellitus support groups are few and mainly in Nairobi but missing in the districts.

9.0 RECOMMENDATIONS

- **Train or re-train** all nurses, clinical officers and doctors involved in the management of diabetes mellitus on the diagnosis, referral and follow-up of diabetic retinopathy. Interdisciplinary approach to Patient care, curriculum review and regular revision ensures knowledge is up to date.
- **Equip** all medical personnel (non-ophthalmologists) involved with diabetes mellitus care with direct ophthalmoscopes and train them in the appropriate use.
- Provide each province and major service eye unit with **a retinal laser unit** (1 per 1,000,000 population) as per NPBWG recommendations; retrain personnel in laser use where necessary.
- Provide **vitrectomy services** in tertiary national referral and teaching hospitals and distributed to peripheral tertiary centres (1 per 10 million population) as per NPBWG recommendations.
- **Sensitize systematically all patients** attending diabetic clinics on the prevention of blindness from diabetic retinopathy through cooperation with stakeholders and professionals such as self help groups, educational specialists etc
- Adopt, adjust, and monitor use of **management guidelines** formulated by DOS / NPBWG based on ICO recommendations on DM and DR.
- Network with **self help groups** and **professional organizations** addressing diabetic retinopathy. Establishment of a central register would map the disease and guide policy
- Encourage, support and participate in systematic **research** on diabetes mellitus and diabetic retinopathy and investigate the role of the private sector and mass media in combating this epidemic.

10.0 STUDY LIMITATIONS

It was not possible to establish the actual numbers of patients with diabetes mellitus as well as diabetic retinopathy. This was because of poor record keeping in most facilities and therefore the figures quoted are estimates from clinicians from the facilities interviewed. The diagnosis of diabetic retinopathy was also a challenge to most clinicians particularly general practitioners and physicians and other lower cadres.

It was also not possible to collect data from some facilities due to logistical reasons particularly NGO/Faith based facilities and some remote Government facilities. This was complicated by the changed MoH and political structures during the study .With the creation of so many new districts, most facilities were upgraded to district hospital status without a corresponding upgrading of its services.

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12.0 APPENDICES.

12.1 CONSENT FORM AND COVERING LETTER

My name is **Dr. David Ngiligo Ekuwam.** I am a postgraduate student at the Department of Ophthalmology, University Of Nairobi in my final year of study.

I am conducting a **Situation analysis of diabetic retinopathy services in Kenya**. This study is a requirement in partial fulfilment of the Master of Medicine in Ophthalmology Degree Course. The study has been cleared by Ministry of Health and Kenyatta National Hospital and University Of Nairobi Ethics and Research Committee (KNH/UON -ERC). The information obtained from the study will be useful to the Ministry of Health and to the Kenya Ophthalmic Programme in identifying the resources and gaps in diabetic retinopathy services and to adequately plan for appropriate diabetic retinopathy services preventing blindness from this epidemic.

I am kindly requesting you to read and carefully fill this questionnaire and participate in a follow up telephone interview to enable me complete the questionnaire. Participation in this study is purely voluntary and the interview can be stopped at any time without giving reason. All information obtained will be treated with confidentiality at any time.

Thank you.

I .....of..... hospital do hereby consent to participate in this study. The details of the study have been explained to me and I understand well.

Dated.....signed.....

I confirm that I have explained the nature of my study and I guarantee the confidentiality of the information provided by the above mentioned participant.

Dated .....signed.....

12.2 QUESTIONNAIRE

QUESTIONNAIRE A: FOR DISTRICT/PROVINCIAL HOSPITALS

PART 1: KEY INFORMANT

Questionnaire number ☐☐☐

Name of interviewee Last Name..... Other Names .....

Qualification of interviewee .....

Position in the health facility of interviewee .....

Contacts of interviewee: Postal address .....

Telephone No. Landline .....

Mobile .....

Email address .....

PART 2: HEALTH FACILITY

---

1. Name of the institution/Health facility .....

2. Physical (geographical) location of the institution/Health facility

   (a) Province **1**. Nairobi **2**. N/Eastern **3**. Eastern **4**. Western **5**. Nyanza **6**. Coast **7**. R/Valley **8**. Central

   (b) District .....

3. Category of health facility (a) Teaching and referral hospital ☐

   b) Provincial hospital ☐

   (c) district hospital ☐

   (d) eye hospital ☐

   (e) others (specify) ..... ☐

PART 3: DIABETES MELLITUS SERVICES

4. Do you have:

	Yes	No
(a) General medical out-patient clinic (MOPC)	☐	☐
(b) Diabetic clinic	☐	☐
(c) Eye clinic	☐	☐
(d) Diabetic retinopathy clinic	☐	☐

5. How many patients do you see per year at the MOPC?

(a) General? ☐☐☐☐

(b)Diabetics? ☐☐☐☐

(c) How many diabetics are referred to the eye unit? ☐☐☐☐

6. Do you routinely screen for diabetic eye disease at MOPC? ☐ Yes ☐ No

7. (i) Do you routinely screen for diabetic retinopathy at MOPC? ☐ Yes ☐ No

(ii)If yes, who does the screening of diabetic retinopathy services?

		Yes	No
(a)	General practitioner	☐	☐
(b)	Physician	☐	☐
(c)	Diabetologist	☐	☐
(d)	Others (specify)	☐	☐

(iii) What methods do you employ for screening?

		Yes	No
(a)	Direct ophthalmoscopy	☐	☐
(b)	Indirect ophthalmoscopy	☐	☐
(c)	Others (specify)	☐	☐

8. (i) Do you refer diabetics for diabetic retinopathy screening? Yes ☐ No ☐

(ii) Where do you refer them? .....

(iii) When do you refer them?

		Yes	No
(a)	Upon diagnosis of diabetes	☐	☐
(b)	When they have eye complains	☐	☐
(c)	When they have eye signs of diabetic retinopathy	☐	☐
(d)	Others (specify)	☐	☐

9. What other professionals / people do you partner with in the care of diabetics?

1. .....
2. .....
3. .....
4. .....
5. .....

10. What can be done to improve eye care for diabetics and prevent visual loss from diabetic retinopathy?

1. .....
2. .....
3. .....
4. .....
5. .....

11. What other institutions within your district/province offer diabetic care services? Follow-up interviews to be done as need arise with separate questionnaire.

Institution	Specify facility and services offered?
1.	...../.....
2.	...../.....
3.	...../.....
4.	...../.....
5.	...../.....

12. Do you have diabetes mellitus patient support groups in the district? Yes..... (Give contacts)... No.....

QUESTIONNAIRE B: FOR EYE HEALTH UNITS/CLINICS

PART 1: KEY INFORMANT

Questionnaire number ☐☐☐

Name of interviewee Last Name..... Other Names .....

Qualification of interviewee .....

Position in the health facility of interviewee .....

Contacts of interviewee: Postal address .....

Telephone No. Landline .....

Mobile.....

Email address .....

PART 2: HEALTH FACILITY

---

1. Name of the institution/Health facility .....

2. Physical (geographical) location of the institution/Health facility

(a) Province **1**. Nairobi **2**. N/Eastern **3**. Eastern **4**. Western **5**. Nyanza **6**. Coast **7**. R/Valley **8**. Central

(b) District .....

(c) Eye zone .....

3. Category of health facility (a) Teaching and referral hospital ☐

b) Provincial hospital ☐

(c) district hospital ☐

(d) eye hospital ☐

(e) others (specify) ..... ☐

PART 3: DIABETES EYE HEALTH SERVICES

4. Do you offer diabetic retinopathy services? Yes ☐ No ☐

5. Do you have a specialized diabetic retinopathy clinic? Yes ☐ No ☐

6. Do you offer the following types of diabetic retinopathy services?

	Yes	No
a) Screening	☐	☐
b) Laser surgery	☐	☐
c) Vitreo- retinal surgery	☐	☐
d) Rehabilitation	☐	☐
e) Patient education	☐	☐
f) Training of eye care workers	☐	☐
g) Others (specify).....	☐	☐

7. What is the mode of referral of your Patients?

	Yes	No
a) self- referrals	☐	☐
b) Referred by general practitioners	☐	☐
c) Referred by physicians from diabetic clinics	☐	☐
d) Referred from eye care facilities	☐	☐
e) Others (specify).....	☐	☐

8. Do you have standard management guidelines (protocol) for diabetic retinopathy?

(a) Yes ☐ (specify)..... (b) No ☐ .....

9. What personnel are involved in screening for diabetic retinopathy?

	Yes	No
(a) Ophthalmologists	☐	☐
(b) Ophthalmic clinical officers	☐	☐
(c) Optometrists	☐	☐
(d) Non-ophthalmic health professionals (General practitioner, Endocrinologist)	☐	☐
(e) Others (specify).....	☐	☐

10. What methods are used for detecting diabetic retinopathy?	Yes	No
(a) Undilated direct ophthalmoscopy	☐	☐
(b) Dilated direct ophthalmoscopy	☐	☐
(c) Indirect ophthalmoscopy - monocular	☐	☐
- Binocular	☐	☐
(d) Retinal photographic techniques (specify).....	☐	☐
d-1 seven-field stereo-photographs	☐	☐
d-2 standard photographs	☐	☐
d-3 digital photographs	☐	☐
11. Where is the screening of diabetic retinopathy done?		
(a) Health care facilities	☐	☐
(b) Community based	☐	☐
b-1 Mobile health vans	☐	☐
b-2 mass community examination	☐	☐
b-3 mobile health care services	☐	☐
12. Do you offer treatment services for diabetic retinopathy?	☐	☐
13. Do have trained personnel for treatment of diabetic retinopathy?	☐	☐
(a-1 General ophthalmologists.	☐	☐
a-2 Vitreo-retinal surgeon	☐	☐
a-3 others (specify)	☐	☐
14. Do you have equipment for treatment of diabetic retinopathy?	☐	☐
a-1 laser	☐	☐
a-2 vitreo-retinal surgery equipment e.g. vitrector for PPV	☐	☐
a-3 others (specify)	☐	☐
15. What measures have you put to ensure Patients adhere to follow-up and treatment plans?		
(a) Health Education	☐	☐
(b) Mobile Clinics	☐	☐
(c) Others (Specify)	☐	☐

16. What can be done to improve treatment services?

1. .....
2. .....
3. .....
4. .....
5. .....

17. What others stakeholders do you have in the management of Patients with diabetic retinopathy?

	Yes	No
(a) Physicians.	☐	☐
(b) Nutritionists	☐	☐
(c) Rehabilitation Workers.	☐	☐
(d) Diabetic associations.	☐	☐
(e) Mass media.	☐	☐
(g) Others (specify)	☐	☐

18. (a) How many patients do you see per year? .....

(b) Out of these, how many are diabetics? .....

(c) Out of these, how many have diabetic retinopathy?

.....

19. (a) Do you refer patients with diabetic retinopathy?

Yes ☐ No ☐

(b) Where do you refer them?

i) Provincial hospital eye clinic .....

ii) Teaching and referral hospital .....

iii) Eye hospital .....

(iv) Dedicated diabetic retinopathy clinic .....

(v) Others (specify) .....

(c) What grades of diabetic retinopathy patients do you refer?	Yes	No
i) Non –Proliferative	☐	☐
ii) Proliferative	☐	☐
iii) CSME Clinically Significant	☐	☐
Macular Oedema	☐	☐
iv) All grades	☐	☐

(d) Why do you refer the above stated grades of diabetic retinopathy?

.....

20. What other institutions offer diabetic retinopathy services in this district/province?

1. .....
2. .....
3. .....
4. .....
5. .....

21. Any other general comments.....

.....

12.3 CLASSIFICATION OF DIABETIC RETINOPATHY [24]

Non-proliferative diabetic retinopathy (NPDR)

- -Mild
- -Moderate
- -Severe

Proliferative diabetic retinopathy (PDR)

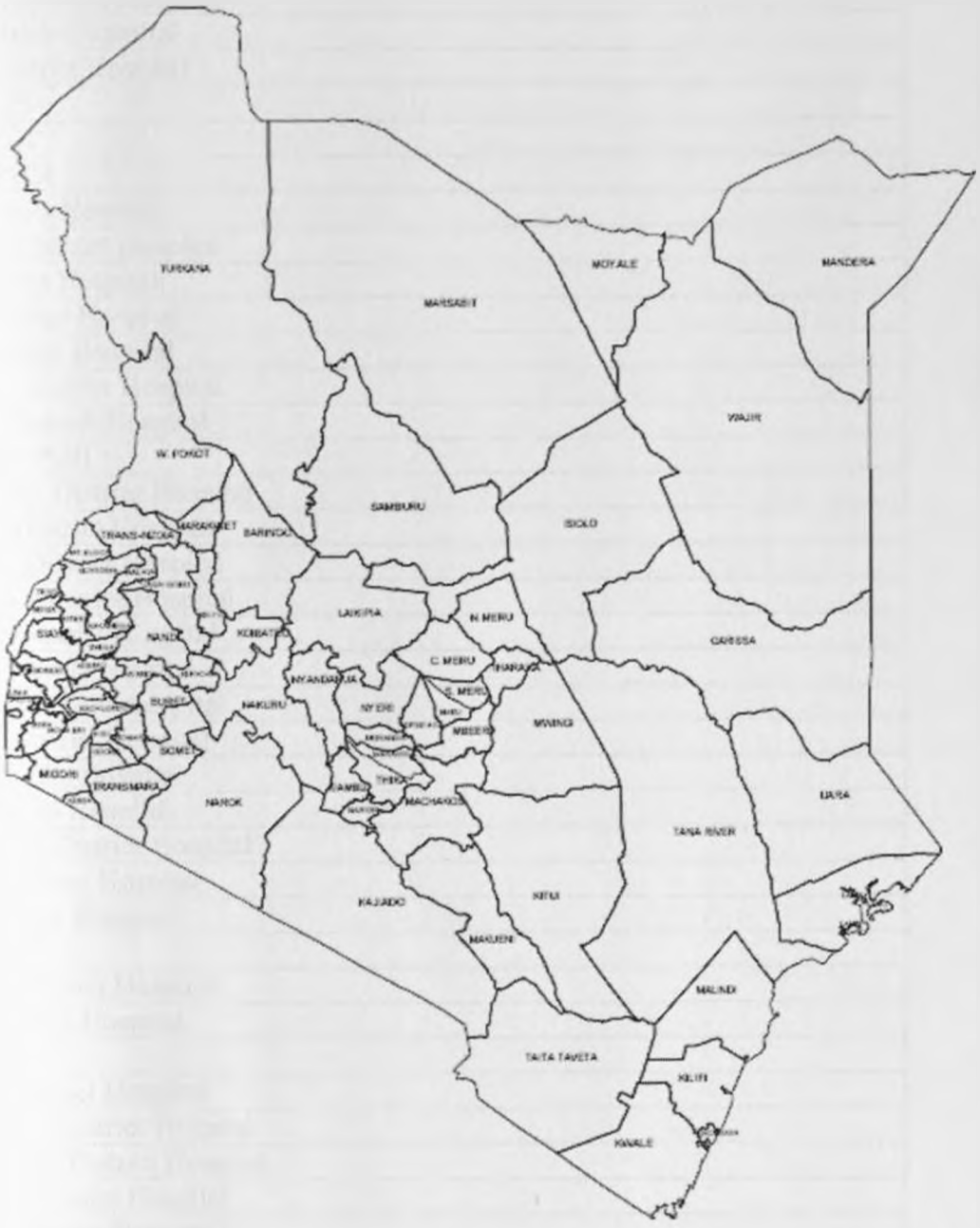
- -Early PDR
- -PDR with high risk criteria
- -PDR including advanced diabetic eye disease

Diabetic maculopathy

- -Macula edema
- -Clinically significant macula edema (CSME)

Some of these stages are not mutually exclusive and may exist together, for instance moderate NPDR and CSME.

12.4 ADMINISTRATIVE MAP OF KENYA (at the time of data collection)



12.5 LIST OF MEDICAL CLINICS STUDIED

MEDICAL CLINICS
Bungoma District Hospital
Busia District Hospital
Chuka District Hospital
Coast PGH
Embu PGH
Garissa PGH
Hola District Hospital
Homabay District Hospital
Ijara District Hospital
Isiolo District Hospital
Iten District Hospital
Kabarnet District Hospital
Kajiado District Hospital
Kakamega PGH
Kapenguria District Hospital
Kapkatet District Hospital
Kapsabet District Hospital
Kapsowar District Hospital
Karatina District Hospital
Kericho District hospital
Kerugoya District hospital
Kiambu District Hospital
Kikuyu PCEA Hospital
Kilifi District Hospital
Kisii level 5 District Hospital
Kisumu District Hospital
Kitui District Hospital
KNH
Koibatek District Hospital
Kwale District Hospital
Light house
Lodwar District Hospital
Loitokitok District Hospital
Lokichoggio District Hospital
Machakos District Hospital
Makueni District Hospital
Malindi District Hospital
Mandera District Hospital
Maralal District Hospital
Marsabit District Hospital
Mbagathi District Hospital
Meru District Hospital
Moi Teaching and Referral Hospital

MEDICAL CLINICS
Moyale District Hospital
Msambweni District Hospital
Muranga District Hospital
Mwingi District Hospital
Naivasha District Hospital
Nakuru PGH
Nanyuki District Hospital
Narok District Hospital
Nyahururu District Hospital
Nyambene District Hospital
Nyamira District Hospital
Nyeri PGH
Ol kalou District Hospital
Port- Reitz District hospital
Siaya District Hospital
Taveta District Hospital
Tawfiq District Hospital
Tenwek
Thika District Hospital
Trans-Nzoia District Hospital
Uasin Gishu District Hospital
Vihiga District Hospital.
Wajir District Hospital
Webuye District Hospital
Wesu District Hospital

12.6 LIST OF EYE CLINICS STUDIED

EYE CLINICS
AMREF
Bandari/Kipevu staff clinics
Bungoma District Hospital
Busia District Hospital
Chogoria
Chuka District Hospital
Coast PGH
Embu PGH
Forces Memorial
Garissa PGH
Hola District Hospital
Homabay district Hospital
Ijara District Hospital
Isiolo District Hospital
Iten District Hospital
Kabarnet District Hospital
Kajiado District Hospital
Kakamega PGH
Kapenguria District Hospital
Kapkatet District Hospital
Kapsabet District Hospital
Kapsowar District Hospital
Karatina District Hospital
Kericho District hospital
Kerugoya District Hospital
Kiambu District Hospital
Kilifi District Hospital
Kisii level 5 District Hospital
Kisumu PGH
Kitui District Hospital
KNH
KNH-UON Clinic
Koibatek District Hospital
KSB
Kwale District Hospital
Light house
Lions-Pwani
Litein hospital
Lodwar District Hospital
Loitokitok District Hospital
Lokichoggio District Hospital
Loresho-Lions
Machakos District Hospital
Makueni District Hospital
Malindi District Hospital

EYE CLINICS
Mandera District Hospital
Maralal District Hospital
Marsabit District Hospital
Mbagathi District Hospital
Meru District Hospital
Moi TRH Eldoret
Moi-Voi District Hospital
Moyale District Hospital
Msambweni District Hospital
Muranga District Hospital
Mwingi District Hospital
Naivasha District Hospital
Nakuru PGH
Nanyuki District Hospital
Narok District Hospital
Nyahururu District Hospital
Nyambene District Hospital
Nyamira District Hospital
Nyeri PGH
Ol kalou district Hospital
PCEA Kikuyu Hospital
Port - Reitz District Hospital
Sabatia
Siaya District Hospital
Sight by wings
Taveta District Hospital
Tawfiq District Hospital
Tenwek Mission Hospital
Thika District Hospital
Trans-Nzoia District Hospital
Uasin -Gishu District hospital
Vihiga District Hospital
Wajir District Hospital
Webuye District Hospital
Wesu District Hospital

APPENDIX 12.7: STRUCTURE OF THE GOVERNMENT HEALTH SERVICES

Category	Facility	Number
Category 2 & 3	Dispensaries and health centres	3300
Category 4	District Hospitals	73
Category 5	Provincial Hospital	8
Category 6	Teaching and referral	2

APPENDIX 12.8: HEALTH FACILITIES PROVIDERS

Type of Institutions	Government	NGO/Mission /private	Total
Hospitals	158	142	300
Health centres	459	193	652
Dispensaries	1503	749	2252
Bamako Initiative	94	824	918

APPENDIX 12.9 (A): HUMAN RESOURCE CURRENT STATUS

Province	Ophthalmologists	Cataract surgeons	OCO	ON	Optometrist	Optician	LVT	Orthoptist	Ophth Techn
Coast	6	7	7	1					
Eastern	3	8	7	2					
North Eastern	1	3	0	0					
Central	4	10	7	2	1				
Nairobi	33	4	22	5	3				
Rift Valley	5	16	16	6	1				
Western	2	3	3	0					
Nyanza	4	3	4	0					
Total	**58**	**54**	**66**	**16**	**5**	**22**	**0**	**0**	**0**

APPENDIX 12.9(B): HUMAN RESOURCE DEVELOPMENT

Training Needs	Placement/outcome	Quantity
Ophthalmologists	District /Provincial	30
OCO/CS	District/Provincial	60
Ophthalmic nurses	Health centres, District, Provincial	100
Low Vision Therapists	District Provincial	20
Equipment Technician	Provincial	2
Eye care Managers	District / Provincial	108
Sensitization of health workers with eye care work	Health centres, MCH's	73 Districts
Leadership, planning advocacy	District / Provincial	Depends upon teams
Retraining of ON's and OCO's in refraction	Health centres and district	
Development of new trainings-instrument techs. Rehab offices, store keeper and procurement officers	District / Provincial	