Prevalence of diabetic retinopathy and barriers to uptake of diabetic retinopathy screening at Embu Provincial General Hospital, Central Kenya

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ABSTRACT

***Background*: The risk of Diabetic Retinopathy (DR) to sight can be greatly reduced by good blood glucose and blood pressure control, effective screening and laser treatment. Diabetic retinopathy remains asymptomatic in its early stages. Substantial barriers to screening and achieving regular eye examinations for people with diabetes include the belief that 'nothing is wrong with my eyes', not being told of the need for eye examinations and being too busy.**

***Objectives*: To determine the prevalence of diabetic retinopathy, to describe the relationship between diabetic retinopathy and the various risk factors and to identify the barriers to uptake of screening for diabetic retinopathy in diabetic patients at Embu Provincial General Hospital, Central Kenya.**

***Study design:* Cross sectional hospital based survey.**

***Subjects*: Two hundred and fifty three type II Diabetics and type I diabetic patients aged twelve years and above attending the diabetic clinic.**

***Results*: The overall prevalence of Diabetic Retinopathy (DR) was 41%. Moderate Non Proliferative Diabetic Retinopathy (NPDR) was the most prevalent grade of DR (20%). Vision threatening DR (Proliferative Diabetic Retinopathy (PDR) and macular oedema) was found in 21 (8.3%) patients. Most of the patients (74%) had hypertension. Duration of diabetes and systolic blood pressure had a significant association with DR ($p< 0.05$). Fasting Blood Sugar (FBS), mode of treatment and age were not significant. Only 29% of the patients had prior eye examination, with majority (84%) citing lack of awareness as the main hindrance.**

***Conclusion*: The prevalence of DR was high. Most of the patients had not had prior eye examination and were not aware of the need or the importance of the eye examination.**

***Recommendation*: Reinforce the existing screening programmes through education and promotion and provision of laser treatment for blinding diabetic retinopathy.**

INTRODUCTION

Diabetes mellitus results in considerable morbidity and mortality, affecting about 180 million people worldwide[1]. The total number of people with diabetes is expected to rise to an estimated 300 million cases by the year 2025. The most significant increase is in developing countries, thought to be the result of population growth, ageing, obesity, and sedentary lifestyles[2]. In developed countries most people with diabetes are above 65 years of age which is above the retirement age, whereas in developing countries those most frequently affected are aged between 35 and 64 years[3]. That means many no longer have a regular income.

Diabetes has many manifestations in the eye, of which cataracts and Diabetic Retinopathy (DR) are the most significant cause of visual impairment and blindness. People with diabetes are 25 times more likely than the general population to become blind[4]. In developed countries, diabetic eye disease represents the leading cause of blindness in adults less than 75 years[5] . DR is the most common complication in type I diabetes and nearly all patients will have some degree of retinopathy 15–20 years after diagnosis. Similarly, more than 60% of type II diabetes sufferers will have evidence of DR during this period[6, 7]. Visual impairment as a result of DR has a significant impact on patients' quality of life, and can compromise their ability to manage successfully their disease, which can in turn have a negative impact on the incidence of other diabetic complications and overall life expectancy[8].

The risk of diabetic retinopathy to sight can be greatly reduced by good blood glucose and blood pressure control, effective screening and laser treatment[9]. Since diabetic retinopathy is asymptomatic in its early stages, substantial barriers to screening and achieving regular eye examinations for people with diabetes include the belief that 'nothing is wrong with my eyes', not being told of the need for eye examinations and being too busy[10,11]. In the developed world, it has been reported that about 26% of patients with type 1 and 36% of patients with type 2 diabetes mellitus have never had their eyes examined. In developing countries, diabetic eye care services are concentrated in the urban areas. There is limited data on magnitude of diabetes and

its complications in the rural setup. Awareness about the available services and indeed, about diabetes and its complications is also lacking[12]. Studies in urban Africa, show high prevalence of DR with only 20% to 40% of diabetics having had prior eye examination by an ophthalmologist [13,14]. It is postulated this figure could be higher in rural set up in Africa, given the limited access to health care.

This study was conducted to determine the prevalence of diabetic retinopathy in patients attending the diabetic clinic at Embu Provincial Hospital, Central Kenya, describe the relationship between diabetic retinopathy and the various known risk factors and to identify the barriers to uptake of screening for diabetic retinopathy in diabetic patients at the hospital.

MATERIALS AND METHODS

A cross sectional hospital based survey was conducted at Embu provincial hospital, central Kenya. The study period was between July and September 2009. All type II diabetic patients and type I diabetic patients aged twelve years and above who gave consent and had a clear media in at least one eye were seen. The calculated minimum sample size was 246. All consecutive patients present during the study period and met the inclusion criteria were seen. After attending their regular diabetic clinic, where fasting blood sugar was tested and blood pressure were taken, the patients were then sent to the eye clinic. Upon arrival at the eye clinic, patients gave informed consent. Data was collected using structured questionnaires which were administered to the patients in an interview. Data was also obtained from the patients' medical records. The patients' eyes were examined in the following order; Visual acuity taken using Snellen's chart, anterior segment examination using a slit lamp, and then the pupils were dilated using 1% tropicamide eye drops. Biomicroscopic examination of the fundus was done using a slit lamp and 90 dioptre loupe. The fundus findings were recorded using the Early Treatment Diabetic Retinopathy Study (ETDRS) classification of diabetic retinopathy.[15] Validation of the data was done before it was entered into the computer for analysis using the Statistical Package for Social Sciences, (SPSS). Results are presented in tables, bar graphs and pie charts.

The following case definitions were used.

Diabetes Mellitus **(**DM) was defined by a self-reported history of physician diagnosis or those who were on drug treatment for diabetes (insulin or oral hypoglycaemic agents) or fasting plasma glucose ≥ 7.0mmol/l (126mg/dl) or 2 hour plasma glucose ≥ 11.1mmol/l (200mg/dl).

Hypertension was defined by a self-reported history of physician diagnosis or subjects who were receiving drug treatment for hypertension or a systolic blood pressure (SBP) of ≥140 mm Hg and/or diastolic blood pressure (DBP) of ≥ 90 mm Hg.

Coronary Artery Disease (CAD) was diagnosed based on a history of documented myocardial infarction and/or drug treatment for CAD (aspirin or nitrates).

RESULTS

The mean age was 59.9 years, range was 11 to 90, and median age was 60 years.

Figure 1: Age distribution (n=253)

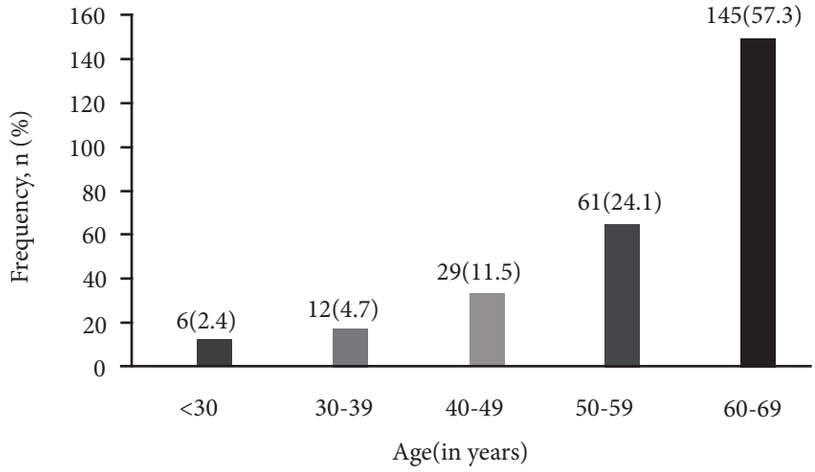
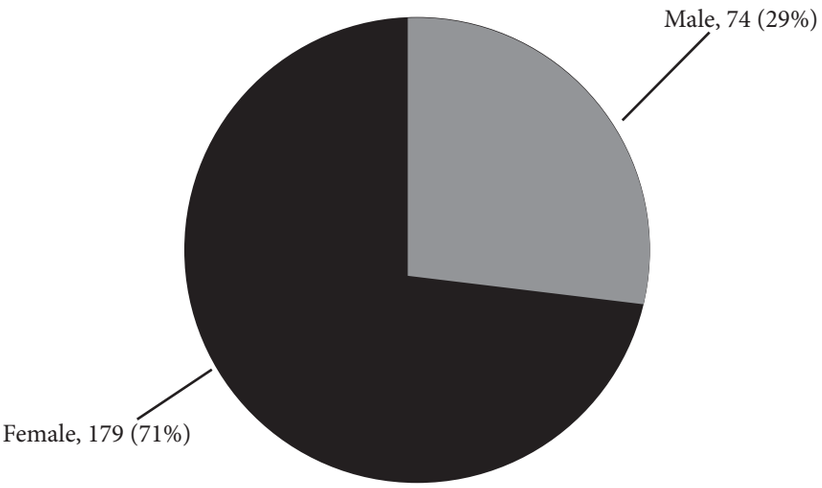


Figure 2: Distribution by sex (n=253)



Male to female ratio was 1:2.4.

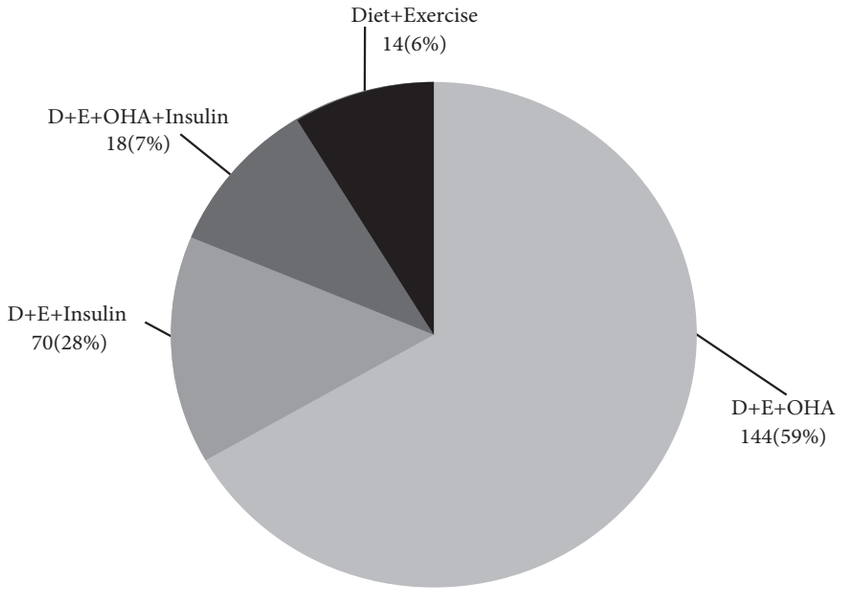
Table1: DM Characteristics (n=253)

Type	Frequency	(%)
I	25	9.9
II	228	90.1
Mode of treatment		
Diet +Exercise (D+E)	14	5.5
D + E + OHA	151	59.7
D + E + Insulin	70	27.7
D + E + OHA + Insulin	18	7.1

The mean duration of diabetes was 7.3 years and median was 5 years.

The mean Fasting Blood Sugar (FBS) was 9.6 mmol/L, range was 2 to 28.6mmol/L, and median was 8.9 mmol/L.

Figure 3: Mode of treatment



Majority of patients, 59% were on Oral Hypoglycaemic Agents (OHA) in addition to diet and exercise (D+E).

Table 2: Prevalence of various grades of DR

Grade of DR	n (Prevalence)
Mild NPDR	26 (10.3)
Moderate NPDR	51 (20.2)
Severe NPDR	10 (4.0)
Very severe NPDR	6 (2.4)
Early PDR	1 (0.4)
High-Risk PDR	9 (3.6)
CSME	12 (4.7)

Fifty nine percent of the patients had no DR, while 41% had at least one grade of DR in at least one eye.

Table 3: Co-existing risk factors for DR (n=253)

	Frequency	(%)
Risk factors		
Hypertension	188	74.3
Dyslipidemia	16	6.3
Nephropathy	3	1.2
Cardiovascular complication of DM	2	7.9

Figure 4: Co-existing risk factors for DR

Table 4: Association between diabetic retinopathy and risk factors

Characteristic	DR, n (%)	p-values
Sex		
Male	29 (27.9)	1
female	75 (72.1)	0.690
Age (years)		
<30	1 (1.0)	1
30-39	3 (2.9)	0.841
40-49	11 (10.6)	0.640
50-59	27 (26.0)	0.388
60+	62 (59.6)	0.401
Duration (years)		
< 5	33 (31.7)	1
5-10	31 (29.8)	0.251
10+	40 (38.5)	<0.001
Mode of treatment		
Diet + Exercise (D+ E)	3 (2.9)	0.124
D +E + OHA	54 (51.9)	0.180
D+ E + Insulin	34 (32.7)	0.122
D+ E+ OHA + Insulin	10 (9.6)	0.196
Fasting Blood Sugar (mmol/L)	73 (70.2)	0.020
Systolic BP (mmHg)	61 (58.7)	<0.001
Diastolic BP (mmHg)	25 (24.0)	0.252

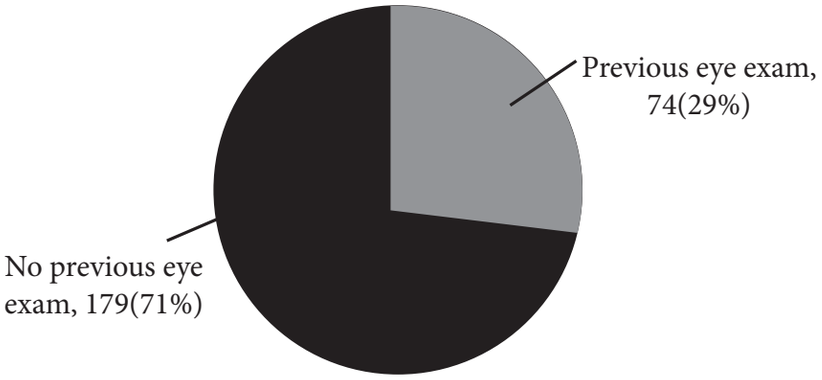
Table 5: Binomial logistic regression of prevalence DM

Parameter Estimates	Esti.	Std. Error	Wald	Df	Sig.	ODDs	95% CI	
Intercept	-4.557	0.99	21.3	1	0.000			
Duration	0.101	0.02	17.3	1	0.000	3	2.9	3.2
FBS	0.013	0.03	0.2	1	0.664	2.7	2.6	2.9
Systolic BP	0.023	0.01	13.1	1	0.000	2.8	2.7	2.9

Only duration of diabetes and systolic blood pressure were significant ($p<0.05$) with FBS becoming non-significant on the multiple regression analysis ($p>0.05$).

The risk of DR increases by 3 times (2.9 to 3.2) with every unit increase in one year of duration and by 2.8 times (2.8 to 2.9) for every unit increase in systolic blood pressure.

Figure 5: Screening for diabetic retinopathy



Only 29% of the patients had previous eye examination by an ophthalmologist.

Table 6: Barriers to uptake of DR screening (n=253)

	Frequency	(%)
Lack of awareness	212	83.8
Economic factors	5	2.0
Logistics	5	2.0
No eye symptoms	25	9.9
Fear of diagnosis	1	0.4
Priority	4	1.6
Forgot appointment	1	0.4

Most of the patients, 84%, reported lack of awareness as the main reason for not having prior eye examination.

DISCUSSION

Diabetes is a major public health problem worldwide. Its management is costly in terms of reduced quality of life, mortality risk, and economic burden on the community and on the family of the diabetic patient. Diabetic Retinopathy (DR) continues to be a major cause of visual disability and blindness worldwide[16]. In this study the overall prevalence of diabetic retinopathy (DR) was 41%. This is within the range of other studies in Africa (18%-49%), though most are urban based, [13, 14, 17] but higher than findings of a study done in a similar region in Central Kenya which showed a prevalence of 18%.[18] The difference in the results could be due to increase in the prevalence of DR over time, poor control of diabetes, high prevalence of hypertension (74% of the study population), socio- economic and environmental factors.

Moderate Non Proliferative Diabetic Retinopathy (NPDR) was the most prevalent grade of DR, which was at 20%. High risk proliferative diabetic retinopathy (HR-PDR) was found in 3.6%. PDR is reported to be less common in type 2 diabetic patients who comprised 90% of our study population. Clinically Significant Macular Oedema (CSME) was found in 4.7% of the patients. Vision threatening DR (defined as PDR combined with macular oedema) was found in 21 (8.3%) patients. Among these, only four patients had laser treatment for the retinopathy.

Most of the patients, 74%, had hypertension as co morbidity. Although the link with blood pressure has been suggested, a causal relationship has not been identified. Hypertension can occur either before or after the development of retinopathy. The U.K Diabetic Prospective study reported a 34% reduction in the progression of DR with intensive management of hypertension [9].

Logistic regression analysis showed that duration of diabetes and systolic blood pressure had a significant association with retinopathy ($p< 0.05$). Fasting Blood Sugar (FBS), mode of treatment and age were not significant in this study. The results showed that risk of DR increased three times (2.9 to 3.2) with every unit increase in one year of duration and by 2.8 times (2.8 to 2.9) for every unit increase in systolic blood pressure. The duration of diabetes has consistently been shown to be one of the most important determinants of DR. It has been suggested that the duration reflects total glycaemic control, a risk factor that involves cumulative damage[19]. In this study, 40% of the patients had duration of more than ten years. None of the patients had glycated haemoglobin (HbA1C) levels tested due to unavailability of the test in the health facility. This would have been a better indicator than FBS since it shows the level of diabetes control over time. In some studies, HbA1C showed significant correlation with DR[20, 21]. The role of hyperglycaemia in the development of diabetic retinopathy is known and has been demonstrated in the diabetes control and complication trial[22].

Seventy one percent of the patients had never had an eye examination before by an ophthalmologist. Majority of these (84%) cited lack of awareness as the main hindrance. A study on barriers to diabetic retinopathy screening in Victoria, Australia indicated that being asymptomatic and not being told of the importance of regular eye examinations were the two most commonly cited reasons for failure to comply with screening guideline recommendations[23]. A qualitative study on patients behaviour with regards to seeking health care in diabetics in Paraguay[24], showed general lack of awareness about diabetes and its possible complications, denial of the disease, and fear of going blind once DR had become established.

Timely and appropriate care for diabetic patients can significantly reduce visual loss over time, improve patients' quality of life and reduce the financial burden associated with the complications of visual impairment. However, as DR can progress irreversibly with relatively few visual symptoms, the importance of early and adequate ophthalmological screening and subsequent treatment for all patients with diabetes is imperative[25]. Despite adequate glycaemic and blood pressure control, DR can progress and once the disease process reaches a certain stage, its effects become irreversible. This is the phenomenon of 'retinopathic momentum'[26].

Nevertheless, screening and treatment have been predicted to prevent approximately three-quarters of expected cases of blindness in areas of the UK. Despite this, studies suggest that over one-third of diabetic patients do not adhere to screening guidelines endangering their visual acuity and long-term health[27]. The reasons for non-attendance are diverse, thus the means to encourage people to attend are equally diverse. The remedies include information and education to the healthcare providers and the community, accessibility of screening services and integrated screening which ties in diabetic retinopathy screening to the other care received by people with diabetes.

CONCLUSION

A high prevalence of diabetic retinopathy was observed in this study. Systolic blood pressure and duration of diabetes had a significant association with DR. Most of the patients had not had prior eye examination and were not aware of the need or the importance of the eye examination despite having screening services been offered at the hospital. Diabetic retinopathy is an important public health problem. Screening for diabetic retinopathy is widely recognized as a cost-effective public health measure. There is therefore the need to capitalize on current screening programmes and treatment options, which must be widely, reliably, and economically applied.

RECOMMENDATIONS

Reinforcing the existing screening programme through education and promotion, introduction of HbA1C as a way of monitoring diabetes control, better management of hypertension in the diabetics and provision of laser treatment for vision threatening DR.

REFERENCES

1. World Health Organisation. *The World Health Report 2002*. Available at: http://www.who.int/whr/en/.
2. King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: prevalence, numerical estimates, and projections. *Diabetes Care* 1998; **21:** 1414–1431.
3. Diabetes action now. An initiative of World Health Organization and international diabetic federation. 2003; Availableat:http://www.who.int/diabetes/actionnow/booklet
4. National Society to Prevent Blindness. Visual Problems in the US Data Analysis Definitions. Data Sources, Detailed Data Tables, Analysis, Interpretation. *National Society to Prevent Blindness:* New York, 1980; pp 1–46.
5. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes in America, 2nd ed. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases: Bethesda, MD, 1995.
6. Klein R, Klein BE, Moss SE, Davis MD, DeMets D.L. The Wisconsin Epidemiologic Study of Diabetic Retinopathy. II. Prevalence and risk of diabetic

retinopathy when age at diagnosis is less than 30 years. *Arch Ophthalmol.* 1984; **102:** 520–526.
7. Aiello LP, Gardner TW, King GL, Blankenship G, Cavallerano JD, Ferris FL *et al.* Diabetic retinopathy. *Diabetes Care.* 1998; **21**: 143–156.
8. Brown MM, Brown GC, Sharma S, Shah G. Utility values and diabetic retinopathy. *Am J Ophthalmol* 1999; **128:** 324–330.
9. U.K prospective Diabetes study (UKPDS) Group. Tight blood pressure control and the risk of microvascular complications in type II diabetics. UKPDS 38. *BMJ.* 1998. **317:** 703-713.
10. Will JC, German RR, Schurman E, Michael S, Kurth DM, Deeb L. Patient adherence to guidelines for diabetes eye care: Results from the diabetic eye disease follow-up study. *Am J Public Health*. 1994; **84:**1669-1671.
11. Moss SE, Klein R, Klein BE. Factors associated with having eye examinations in persons with diabetes. *Arch Fam Med.* 1995; **4:**529-534.
12. Aurangzeb S, Faheemullah S, Ziauddin A, Jamshed A. Prevalence of diabetic retinopathy and influence factors among newly diagnosed diabetics in rural and urban areas of Pakistan: Data analysis from the Pakistan National Blindness & Visual Impairment Survey 2003. *Pak J Med Sci.* 2008 (Part-II); **24** (6): 774-779.
13. Kariuki M.M. *et al*. The prevalence, pattern and associations of Diabetic Retinopathy among black African diabetics attending the medical diabetes clinic at KNH. M.Med Dissertation, U.O.N 1999.
14. Mutangana F, Kariuki M, Karimurio J. The magnitude and pattern of diabetic retinopathy as seen at three hospitals in Kigali, Rwanda. M.Med. Dissertation, University of Nairobi. 2008.
15. Early Treatment Diabetic Retinopathy Study Research Group. Classification of diabetic retinopathy from fluorescein angiograms. ETDRS report number 11.*Ophthalmology.* 1991; **98**(5 Suppl):807-822.
16. Fong DS, Aiello L, Gardner TW, King GL, Blankenship G, Cavallerano. JD, *et al* for the American diabetic association. Diabetic retinopathy. *Diabetic Care*. 2003; **26**: S99-102.
17. Lutale J, Thordarson H, Sanyiwa A, Mafwiri M, Vetvik K, Krohn J. Diabetic retinopathy prevalence and its association with microalbiminuria and other risk factors in patients with type 1 and type 2 diabetes in Dar er Salaam, Tanzania. *East Afr J. Ophthalmol*. 2009; **15** (1): 3-10.
18. Kibata G, Kollmann M, Adala H. The prevalence, pattern and risk factors of diabetic retinopathy among diabetic patients attending peripheral health institutions in central Kenya. M.Med. Dissertation. University of Nairobi. 2001.
19. Dowse G, Humphrey A, Collins V. *et al*. Prevalence and risk factors for diabetic retinopathy in the multiethinic population of Mauritius. *Am J Epidemiol*. 1998; **147:** 448-457.
20. Agrawal R, Ranka M, Beniwal R, Gothwal S, Jain G, Kochar D, Kothari R. Prevalence of diabetic retinopathy in type 2 diabetes in relation to risk factors: hospital based study. *Int J. Diab. Dev. Countries*. 2003*;* **23:** 16-19.
21. Haytham I.S, Mona PN, Nadine MT, Marie M, Sandrah H, Jaafar E, *et al*, Prevalence and determinants of retinopathy in a cohort of Lebanese type II diabetic patients. *Can J Ophthalmo*. 2009; **44**(3).308-313.
22. DCCT Research Group. The effect of intensive treatment of diabetes on the development and progression of long term complications in insulin dependent diabetes mellitus. *N Eng J Med.* 1993; **329;** 977-986.
23. Sikivou TB, McCarty CA, Harper CA, Keeffe JE. Barriers to access of eye examinations for people with diabetes . *Aust NZ J Ophthalmol.* 1999; **27**:281.
24. Miriam RC. Prevalence of diabetic retinopathy and barriers to uptake of eye care services by diabetic patients at the Social Security Institute Central Hospital in Asunción, Paraguay. *Community Eye Health*. 2007; **20**(61): 10–11.
25. Bailey CC, Sparrow JM, Grey RH, Cheng H. The National Diabetic Retinopathy Laser Treatment Audit. III. Clinical outcomes. *Eye.* 1999; **13:** 151–159. | *PubMed*
26. Williams R, Airey M, Baxter H, Forrester J., Kennedy Martin T., Girach A. Epidemiology of diabetic retinopathy and macular oedema: a systematic review. *Eye.* 2004; **18:** 963–983.
27. Schoenfeld ER, Greene JM, Wu SY, Leske M.C. Patterns of adherence to diabetes vision care guidelines: baseline findings from the Diabetic Retinopathy Awareness Program. *Ophthalmology.* 2001; **108:** 563–571.