

Knowledge and utilization of diabetic retinopathy screening services among diabetic patients: A study at the Nakuru Level 5 Hospital, Kenya

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Abstract

Introduction: Diabetic Retinopathy (DR) is a leading cause of vision loss globally. Early detection and timely treatment of DR through screening can avert vision loss.

Objectives: The aim of this study was to assess the knowledge of DR, utilization of DR screening services (DRS), and factors associated with utilization of DRS among diabetic patients attending the Nakuru Level 5 Hospital in Kenya.

Materials and Methods: This hospital-based cross-sectional study used a quantitative approach and targeted 228 patients aged 18 years and above attending the Nakuru Level 5 Hospital Diabetic Clinic. A structured questionnaire was used to assess knowledge of DR, utilization of DRS, and factors associated with knowledge and utilization of DRS. Descriptive statistics, bivariate, and multivariate analyses were conducted.

Results: The response rate was 100%. Mean age of respondents was 51 years (range 18 - 86 years), 56.6% (129/228) had knowledge of DR, 33.8% (n=228) had utilized DRS. Factors positively associated with DR knowledge were higher education ($p<0.0001$) and higher income ($p=0.002$). On multivariate analysis, only higher education level was positively associated with knowledge of DR (OR 1.5 [95% CI 1.1-2.3], $p=0.029$). Factors positively associated with DRS utilization included knowledge on diabetic retinopathy ($p<0.001$), higher education level ($p=0.05$), residing in an urban area ($p=0.039$) and higher income level ($p=0.031$). On multivariate analysis, higher education level (OR 4.1 [95% CI 1.4-11.7], $p=0.008$) was positively associated with utilization of DRS.

Conclusion: Knowledge and utilization of DRS in Nakuru Level 5 Hospital was sub-optimal. Higher level of education was associated with increased knowledge and utilization of DRS. Strategies to increase knowledge and utilization of DRS are needed.

Key words: Knowledge, Utilization, Diabetic retinopathy screening services

Introduction

Diabetic Retinopathy (DR) is the most frequently occurring complication of diabetes mellitus and remains a leading cause of vision loss globally^{1,2} in the working age group^{3,4,5}. With the rising prevalence of diabetes, the prevalence of DR and other diabetic complications are expected to increase⁶. Diabetic Retinopathy results from damage to retinal blood vessels, which may bleed or scar and may lead to blindness⁵.

The 2019 World Report on Vision estimated the global prevalence of DR to be 34.6%^{5,7}. A systematic review of DR studies done in Africa found the prevalence of DR to range from 10.0% to 47.0%, with population-based surveys showing the highest prevalence compared to hospital based studies⁸. In Kenya, the Ministry of Health (MOH) estimates the prevalence of DR among patients with

diabetes to be 35.9% based on a population-based study done in 2014^{9,10,11}. Recent Kenyan data on DR prevalence based on hospital-based studies reported a lower prevalence, with one study done in 2018, estimating the prevalence to be 16.3%¹².

The MOH has developed guidelines on diabetic retinopathy management and recommends screening of all patients with diabetes, early diagnosis and timely treatment of DR¹³. Late detection of DR is costly to treat and may lead to permanent visual impairment or blindness⁵. Despite these guidelines, the uptake of DR screening is still low in some counties.

Patient knowledge of DR is important in ensuring compliance to diabetes management. Several studies have linked knowledge of DR to utilization of DR services^{14,15}. Low knowledge and utilization of DR services have been associated with poor general education and low functional health literacy¹⁵. In two studies, higher education level was significantly associated with having both knowledge and utilizing DR services^{16,17}. Longer duration of diabetes has been positively associated with knowledge of DR and utilization of DRS^{15,20}.

Patient related barriers to utilization of DRS vary. Socio-demographic factors such as older age^{14,15}, sex, area of residence and monthly income may affect utilization of DR services^{15,16,17}. The cost of DR service as a barrier to accessing DR services was demonstrated in a systematic review by Piyasena et al., and two other studies done in Nigeria and Saudi Arabia^{15,17,19}.

Nakuru level 5 has a comprehensive diabetic clinic that has integrated DRS. Due to its central location, the hospital serves as a regional referral center¹⁸. Patients presenting to the Diabetic clinic are also screened for DR using a fundus camera stationed at the clinic and advised on appropriate follow-up or referral. However, despite the availability of these services, not all patients undergo screening, a challenge also acknowledged by the MOH. This study therefore aimed to assess the knowledge of diabetic retinopathy, utilization of DRS, and factors associated with utilization of DRS among diabetic patients attending the Nakuru Level 5 Hospital in Kenya.

Materials and methods

This was a hospital based cross-sectional study that used quantitative approach, conducted at the Nakuru Level 5 Hospital, a regional referral hospital located within the Great Rift Valley in Kenya. The study period was from May to June 2022.

The sample size was 228 patients, based on Fischer's formula. This formula has been used for other DR studies in Kenya¹².

$$\text{Minimum sample size} = e \frac{d^2 b(1-b)}{c^2}$$

Where: e= expected design effect (1 since we don't expect clustering when individuals are sampled), d=95% confidence interval (z score 1.96), b= expected prevalence (expected prevalence of DR in diabetic patients in hospital-based studies = 16%¹² and c= margin of error (5%). The minimum sample size = 207. If we add 10% for likely nonresponse, the sample =207+21= 228.

Sample size = 228

All patients aged 18 years and above were eligible for the study and were recruited consecutively until the sample size of 228 had been achieved. A structured questionnaire uploaded onto a digital data collection platform (ONA) was administered by research assistants after obtaining written consent. The questionnaire collected data on knowledge of DR, utilization of DR screening services and factors associated with knowledge and utilization of screening services.

SPSS version 25 was used to analyze the data and involved drawing descriptive statistics, bivariate and multivariate analysis with a significance level set at 0.05. Comparative analysis of those who had knowledge on DR and those without; and those who had utilized DR screening services and those who had not was done.

The research protocol was approved by the Amref Ethics and Scientific Review Committee. The National Commission for Science Technology and Innovation issued the research license, while the hospital research committee and the hospital administration authorized data collection at the hospital.

Results

Patient Socio-demographic and Diabetes Mellitus characteristics

The response rate was 100%. Respondents mean age was 51 years with a range of 18-86 years. Most respondents (73.7%) were over 40 years old and 61.0% were female. Almost all the respondents (98.0%) had visited the diabetic clinic at least once in the 6 months preceding data collection. The mean duration of diabetes was 6.99 years, with over 70.0% having had diabetes for 10 years or less. Most (73.7%) of the respondents had a health insurance cover but this did not cover DR screening (Table 1).

Table 1: Patient Socio-demographic Characteristics (n=228)

Variable	Number of patients	Number of patients	Percentage
Age Group	18-40 years	60	26.3
	41-60 years	98	43.0
	>60 years	70	30.7
Sex	Female	139	61.0
	Male	89	39.0
Highest level of education	Never been to school	7	3.1
	Primary	67	29.4
	Secondary	105	46.1
	Tertiary education	49	21.5
Residence	Urban	115	50.4
	Rural	66	28.9
	Peri-urban	47	20.6
Distance from hospital in kilometers (km)	≤30	149	65.4
	31-60	44	19.3
	≥60	35	15.4
Average income per month (US Dollars)	≤150	168	73.7
	151- 300	44	19.3
	≥300	16	7.0
Insurance cover	No	60	26.3
	Yes	168	73.7
Duration of diabetes in years	<1 year	33	14.5
	1-10 years	135	59.2
	11-20 years	52	22.8
	>20 years	8	3.5
Duration since last diabetic clinic visit	<6 months	217	95.2
	6-12 months	10	4.4
	>12 months	1	0.4
Mode of payment for treatment at the diabetic clinic*	Self	132	57.9
	Support by relatives	54	23.7
	National Health Insurance Fund	147	64.5
	Private Insurance	23	10.1
	Employer	1	0.4

Patient knowledge of Diabetic Retinopathy

Fifty-six-point six percent of the respondents were aware of what DR was, 69.8% knew that diabetes could lead to blindness and 65.9% reported the diabetic outpatient clinic as their source of information on DR. The knowledge of DR symptoms and effects were as shown in Table 2.

Table 2: Knowledge of DR symptoms and effects (n=129)

Variable		Responses	Percentage
Effects of DR on the eyes*	Blindness	90	69.8
	Visual impairment	80	62.0
	Eye pain	47	36.4
	Cataracts	44	34.1
When to go for an eye exam*	At least once a year or as advised	58	45.0
	When they experience reduced vision	56	43.4
	On experiencing eye pain	77	59.7
	Once in 5 years	0	0.0
	No need to go for eye exam	0	0.0
Source of information on DR*	Community Health Workers	18	14.0
	Diabetic clinic	85	65.9
	Media	21	16.3
	Other Health workers	32	24.8

*These were multiple response question targeting those who had knowledge of DR.

Most of the patients' socio-demographic characteristics including age, sex, area of residence, distance from the hospital, insurance cover and duration of diabetes were not associated with knowledge of DR (p value >0.05) (Table 3). Bivariate analysis showed higher education (p<0.0001) and higher income (p=0.002) to be positively associated with knowledge of DR. After adjusting for all other factors, higher education level was independently associated with knowledge of DR (OR 1.5 [95% CI 1.1-2.3], p=0.029) on multivariate analysis as shown in Table 4.

Table 3: Bivariate analysis of patient factors association with knowledge and utilization of DR services

Variable		Knowledge of DR			Utilization of DR services		
		No	Yes	P-value	No	Yes	P-value
Age	18-40 years	24	36	0.762	42	18	0.561
	41-60 years	45	53		66	32	
	>60 years	30	40		43	27	
Gender	Female	66	73	0.122	95	44	0.398
	Male	33	56		56	33	
Education level	Never been to school	6	1	<0.0001	7	0	0.050
	Primary	31	36		49	18	
	Secondary	53	52		68	37	
	Tertiary	9	40		27	22	
Residence	Urban	43	72	0.145	69	46	0.039
	Rural	31	35		44	22	
	Peri-urban	25	22		38	9	
Cost of travel to hospital(US Dollars)	<1	76	103	0.831	121	58	0.583
	1-2	20	22		25	17	
	>2	3	4		5	2	
Monthly income (US Dollars)	≤150	82	86	0.022	119	49	0.031
	151- 300	12	32		25	19	
	≥300	5	11		7	9	
Duration of Diabetes	up to 1 year	14	19	0.309	27	6	0.070
	1-10 years	59	76		81	54	
	11-20 years	25	27		38	14	
	>20 years	1	7		5	3	

Table 4: Multivariate analysis of patient factors association with knowledge and utilization of DR services

Multivariate Analysis						
Predictor	Coefficient	S.E.	p-value	OR	95% C.I. for OR	
					Lower	Upper
Knowledge on DR						
Education level	.446	.204	.029	1.562	1.047	2.329
Income	.304	.269	.257	1.356	.801	2.295
Utilization of DR screening services						
Education level	1.412	.534	.008	4.103	1.440	11.692
Residence	-.833	.525	.113	.435	.155	1.217
Income	.678	.740	.360	1.969	.461	8.404

Patient utilization of DR services

Only 33.8%(77) of the respondents had undergone DR screening. Most (70.1%) had been referred from the Diabetic Outpatient Clinic. The reasons for not utilizing DR screening services included patient preference (38.5%) and inability to afford (21.2%) as shown in Table 5. The cost of DR screening using the fundus camera in the diabetic clinic was KES 500 (approximately 4 US Dollars) at the time of data collection, but was paid out of pocket since it was not covered by the national health insurance.

Table 5: Utilization of DR screening services

Variable		Number of patients	Percentage
When was the last eye exam (n=77)	0-12 months	51	66.2
	13-24 months	15	19.5
	Above 25 months	11	14.3
Who referred for eye exam (n=77)	Self	15	19.5
	Diabetic clinic	54	70.1
	Health worker/outreach/other	8	10.4
Reason for not utilizing DR screening services among those who had knowledge on DR and had not utilized DRS (n=52)	Long waiting time in the eye clinic	9	17.3
	Cannot afford	11	21.2
	Lack of time	6	11.5
	Lack of services	7	13.5
	Patients' preference	20	38.5

Having knowledge of DR was positively associated with utilization of DR screening services ($p<0.001$). Although older patients appeared to have utilized DR screening services more than the younger ones, the differences were not statistically significant ($p=0.561$). Higher education level ($p=0.05$), residing in an urban area ($p=0.039$) and higher income ($p=0.031$) were associated with increased likelihood of utilizing DR screening services (Table 3). After adjusting for all other factors, higher education level (OR 4.1 [95% CI 1.4-11.7], $p=0.008$) was independently associated with the likelihood of having utilized DR screening services on multivariate analysis as shown in Table 4.

Bivariate analysis showed higher education ($p<0.0001$) and higher income ($p=0.002$) to be positively associated with knowledge of DR. After adjusting for all other factors, higher education level was independently associated with knowledge of DR (OR 1.5 [95% CI 1.1-2.3], $p=0.029$) on multivariate analysis as shown in Table 4.

Discussion

There is evidence to demonstrate that the risk of vision loss in DR can be reduced through effective screening and early treatment¹⁵. However, most hospitals in middle and low-income settings do not conduct routine screening

for DR in diabetic patients and only do so when patients present with visual symptoms¹⁵. In this study, the utilization of DR screening services was low, with only 33.8% of the respondents screened. Two studies done in Ethiopia and Kenya also showed low utilization of DR services^{20,23}. Our findings were lower than what was found in a study done in Saudi Arabia, where over 90% of the respondents had done an ocular exam¹⁶.

Having knowledge on diabetic retinopathy ($p < 0.001$), was associated with utilization of DR screening services. On bivariate analysis, utilization of DR services was positively associated with education level, area of residence and income level but was not associated with most of the other sociodemographic characteristic. Although a higher number of older patients appeared to have utilized DR screening services compared to the younger ones, the differences were not statistically significant ($p = 0.561$). This is similar to what Nathaniel et al. observed in a study done in Nigeria. In contrast some studies found a positive association of utilization of DR services with age groups above 40 years^{14,16}. There were more females (61.0%) compared to males in this study, but there was no significant difference between the two sexes on utilization of DR screening services. This is consistent with what was observed in two studies carried out in Ethiopia and Nigeria^{20,22} and contrasts with two studies done in Saudi Arabia and Nigeria, where there was a significant difference in the utilization of eye care services between the males and females^{16,17}. The difference is possibly attributed to different country contexts; it is therefore important to understand a country's context when planning for DR services.

There was a significant association between the level of education and utilization of DR screening services. Two studies done in Saudi Arabia and Nigeria found that education level was significantly associated with having both knowledge and utilizing DR services^{16,17}. Two studies done in Nigeria and Ethiopia had different findings, where the level of education did not increase the likelihood of the respondents utilizing DR screening services^{20,22}.

Most (73.7%) of our respondents had health insurance cover but this did not cover the entire the spectrum of DM services including DR screening. This, coupled with low average income by most respondents could have hindered access to DR screening services. Most respondents earned less than 20,000 Kenyan Shillings monthly (equivalent to 150 USD) and had to pay for other services towards diabetes treatment including consultation fee, medicines, and transport costs. Twenty-one percent of the respondents reported the cost of screening as a barrier. A systematic review done in 2019 demonstrated a positive association between insurance cover and utilization of DR screening services¹⁵.

Only 56.6% of the respondents were aware of what DR was, and most of them could correctly identify some of the ocular presentations of diabetes such as visual impairment, blindness, and cataracts. Some studies done in the Ethiopia, Saudi Arabia, Nigeria and Kenya had similar findings^{16,20,21,22,23}. While bivariate analysis showed higher education level ($p < 0.0001$) and higher income ($p = 0.002$) were positively associated with knowledge on DR; multivariate analysis showed that higher education level was independently associated with knowledge of DR (OR 1.5[95% CI 1.1-2.3], $p = 0.029$) with respondents who had completed some level of education being 1.5 times more likely to have knowledge of DR compared to those with no education.

In a systematic review on barriers and enablers for access to DRS, low knowledge and utilization of DR services was associated with poor general education and low functional health literacy¹⁵. Other studies have also shown education level significantly associated with having both knowledge and utilizing DR services^{16,17}. Further, a systematic review on barriers in accessing DRS in different income settings observed that diabetic patients who underwent diabetes education had increased uptake of DRS compared to those who had not had any education on diabetes¹⁵.

The most common source of information on DR was the diabetic clinic (65.9%). This is similar to what a systematic review and two other studies in Nigeria found^{15,20,21}, where they observed that the diabetic clinic provides a very good avenue for disseminating information and creating awareness on DR, and that medical staff in the diabetic clinic should be equipped with adequate information on DR to include in their daily talks to the patients²⁰.

In the systematic review done by Piyasena et al., various studies found that patients who had received education on DR and DM were more likely to utilize DR screening services compared to those who had not received any education on DR¹⁵. The 40% who had knowledge on DR but had not gone for screening were further asked why they had not utilized the services. Some of the reasons given were: long waiting time in the eye clinic (17.3%), patients' preference (38.5%), lack of services (13.5%) and lack of time (11.5%). A study done in Nigeria found that the lack of felt need and ignorance of DR accounted for the commonest barrier to utilization of eye care followed by the cost of treatment¹⁷. Patient preference and lack of time, reported in this study may be due to patient ignorance on DR.

Despite the mean duration of diabetes being 6.99 years in this study, there was no significant association between duration of diabetes and having knowledge or utilizing DR screening services. Other studies have found a positive

association between longer duration of DM and increased knowledge on DR, because increased duration meant increased chances of contact of a diabetic patient with the health care system and increased chances of accessing information on diabetes^{14,20}. Clinic visits for routine diabetes care present an opportunity for DR screening; thus, low levels of knowledge on DR among respondents regardless of clinic visits and duration of DM suggest a missed opportunity to educate patients at the diabetic clinic and screen for DR. Two studies found that a longer duration of diabetes increased the likelihood of occurrence of diabetic ocular complications such as DR, and increased the likelihood of having knowledge on DR and utilizing eye care services^{14,20}.

Conclusion

Knowledge and utilization of DR screening services in Nakuru Level 5 Hospital was sub-optimal and could lead to delays in seeking treatment. Higher level of education was associated with increased knowledge and utilization of DR screening services. There is need to develop strategies to increase knowledge and utilization of DR screening services, particularly among individuals with lower levels of education.

Authors contributions

Bitok Monicah – Principle Investigator

Kuria Shiprah - Co-investigator

Karimurio Jefitha – Co-investigator

Wamalwa Simiyu – Data Analysis

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