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ORIGINAL ARTICLE IN PUBLIC HEALTH AND DIABETOLOGY

Knowledge, attitude and predictors of diabetic retinopathy screening among patients with type 2 diabetes in Nairobi County, Kenya

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Abstract

Introduction: Aim of this study was to explore the level of knowledge and attitude towards diabetic retinopathy screening as well as predictors of its utilization of amongst People Living With Diabetes (PLWD) in Nairobi County, Kenya.

Methods: A mixed-method cross-sectional study design was employed. Multistage sampling technique was adopted for selecting persons with diabetes attending 'level three' health facilities. A questionnaire ad hoc was developed and used. Ordinal logistic regression models with stepwise method were employed on variables with statistical significance at chi square tests ($P < 0.05$) to determine the significant predictors of diabetic retinopathy screening.

Results: A total of 200 patients (rate of respondents: 96%) participated in the study. Our findings revealed a low utilization level ($n = 21$, 10.5%) of diabetic retinopathy screening by participants.

Significant predictors of utilization of diabetic retinopathy screening were education level [(OR = 4.411; 95% Confidential Interval (CI) 1.504 to 28.636; *P* = 0.018)], presence of family history of diabetes (OR = 11.112; CI 1.554 to 59.444; *P* = 0.016), and primary clinician referral (OR = 3.263, CI 1.498 to 21.357; *P* = 0.027).

Discussion and Conclusion: There is poor knowledge by PLWD in Kenya on the recommended frequency of diabetic retinopathy screening. Moreover, PLWD showed poor attitude towards DR screening utilization, which could be attributed to insufficient knowledge on the importance of regular retinal examination. Educational messages developed by government and policymakers should focus on the recommended interval for eye examinations, importance of regular diabetic retinopathy screening and empowering PLWD to request/demand for eye examination. Target population should include PLWD, their families, health care providers and the general public.

KEY WORDS: Attitude; diabetes complications; diabetes mellitus; diabetic retinopathy; Kenya; knowledge.

Riassunto

Introduzione: L'obiettivo di questo studio è stato quello di esplorare il livello di conoscenza e l'attitudine verso lo screening per la retinopatia diabetica cosi come i fattori predittori della sua utilizzazione tra le persone affette da diabete mellito a Nairobi County, in Kenya.

Metodi: E' stato impiegato uno studio trasversale con disegno misto. Una tecnica di campionamento a stadi multipli è stata adottata per selezionare le persone affetti da diabete mellito che frequentavano le strutture saniitarie di "terzo" livello. Un questionario ad hoc è stato messo a punto ed usato. Modelli di regressione logistica ordinale con metodo stepwise sono stati

impiegati sulle variabili risultate statisticamente significative al test del chi quadrato ($P < 0.05$) per determinare i predittori significativi di screening per la retinopatia diabetica.

Risultati: Un totale di 200 pazienti (tasso di rispondenti pari al 96%) ha partecipato allo studio. I nostri risultati hanno rivelato un basso livello di utilizzazione ($n = 21$, 10.5%) dello screening per la retinopatia diabetica da parte dei partecipanti. Predittori significativi di utilizzazione dello screening sono risultati il livello educativo (OR = 4.411; 95% IC = 1.504-28.636; $P = 0.018$), la presenza di familiarità per diabete (OR = 11.112; IC = 1.554-59.444; $P = 0.016$) e l'invio da parte del medico curante (OR = 3.263, IC 1.498-21.357; $P = 0.027$).

Discussione e Conclusioni: C'è una scarsa conoscenza in Kenya da parte delle persone che vivono con il diabete mellito della frequenza raccomandata per lo screening per la retinopatia diabetica. Inoltre, essi hanno dimostrato una scarsa attitudine per l'utilizzo di tale screening, che potrebbe essere attribuito all'insufficiente conoscenza dell'importanza di un regolare esame del fondo oculare. Messaggi educativi da parte del governo e dei decisori politici dovrebbero focalizzarsi sull'intervallo raccomandato per effettuare la visita oculistica, sull'importanza dello screening regolare per la retinopatia diabetica e sull'incoraggiamento delle persone affetti da diabete a richiedere la visita oculistica. La popolazione obiettivo dovrebbe includere le persone affette da diabete, le loro famiglie, i fornitori di assistenza sanitaria ed il pubblico in generale.

TAKE HOME MESSAGE: Our Kenya-based study showed an insufficient knowledge and poor attitude towards diabetic retinopathy (DR) screening among "People Living With Diabetes". Predictors of DR screening use were education level, presence of family history of diabetes and primary clinician referral.

Competing interests: none declared

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INTRODUCTION

Diabetes mellitus (DM) affects millions of people worldwide and its incidence rate is increasing also in developing countries. In 2015, 415 million adults were estimated to be affected by DM and the global burden is estimated to increase to 642 million adults by 2040 [1]. In Africa, DM prevalence rate was estimated to be 3.8% in 2015 and the number of people with diabetes is expected to increase by 140% between 2015 and 2040 [2]. In Kenya, the prevalence of diabetes was estimated to be 10.7% among urban and 2.7 % among rural dwellers in a report published by the Kenya Diabetes Management and Information Centre (DMI Centre), which is a not-for-profit registered medical charity founded in May 1999 with the aim of educating the public about diabetes [3], differently from a 2005 research with statistics showing a higher prevalence of 14.4% in major urban areas of Kenya [4].

Diabetes poses a significant public health challenge as it results in serious and life-threatening complications. Diabetic retinopathy (DR) is one of the most severe and common eye complications of diabetes. Approximately, a third of global population living with diabetes have

signs of DR and a further third of this group have reached sight threatening stage [1]. DR is the leading cause of avoidable blindness amongst the working age population worldwide [1, 5]. In Kenya, several studies conducted have demonstrated that diabetic retinopathy is rising at an alarming rate among People Living With Diabetes (PLWD). A population-based survey in Nakuru County, Kenya reported that 35.9% of people living with diabetes are affected by DR [5]. A 41% diabetic retinopathy prevalence was reported in Embu provincial Hospital, which is a Ministry of Health provincial general hospital located in Embu County, Kenya [7]. Ekuwam in his study found a 40% prevalence of people with DR in Nairobi province [8], whereas Kenya Society for the Blind estimated that DR contributes to about 3% of the Kenya's blindness [9]. These findings demonstrate that it is urgent to implement all the control and preventative measures aimed at curbing the rising problem of diabetes and its complications. Early and regular screening for diabetic retinopathy is an effective prevention measure against blindness. However, prevention of blindness due to diabetic retinopathy is based not only on early detection but also on timely treatment of this condition. As DR can be asymptomatic until the condition is fairly advanced, regular retinal examination is extremely important [6]. The recommended clinical guidelines released by American Academy of Ophthalmology require that DR screening should be carried out at least once per year for every person living with diabetes [10]. It has also been proven that regular DR screening of PLWD is effective in preventing blindness and is cost-effective as well [11]. Moreover, screening at primary level health facilities is crucial, because when general practitioners visit PLWD, generally DR is detectable at an early stage. Therefore, primary health physicians can play a critical role by referring the patients to ophthalmology services at recommended intervals and, also by educating them about the importance of regular

retinal examinations [9]. However, utilization of diabetic retinopathy screening services remains a major challenge in developing countries like Kenya. The reasons for non-attendance at DR screening could be diverse and, as a consequence, the ways for encouraging people to follow the screening could be diverse [7]. Having in mind this background, our study was conducted to explore the predictors of utilization of diabetic retinopathy screening amongst persons with diabetes attending selected primary health facilities in Nairobi County, Kenya. Secondary objectives of this study were: 1) To determine the level of utilization of DR screening and; 2) to establish the level of knowledge of the respondents on diabetes and DR screening and their attitude towards screening. These answers could give precious information to the government of Kenya and all the stakeholders to improve utilization of diabetic retinopathy screening amongst people living with diabetes mellitus.

METHODS

Study design and sampling

A mixed-method cross-sectional study design was employed to explore the level and predictors of utilization of screening services for diabetic retinopathy amongst persons with diabetes attending diabetic clinics from selected 'level three' health facilities in Nairobi County, Kenya. 'Level three' health facilities are primary health centres, where patients first encounter with primary health professionals. These health facilities do not have eye care services, therefore patients who need eye care are referred to 'level two' health facilities. Multistage sampling technique was adopted for this study. In the first stage, two-stage cluster sampling was used to randomly select the sub counties to be included in the study. Purposive sampling was then used to select health centers with active diabetic clinics namely; Westlands, Kariobangi, Makadara,

Lang'ata and Ngaira Health Centres. Based on a 14.4% diabetes prevalence in urban Kenya, the sample size was calculated to be 189 using the Fisher's formula:

$n = z^2pq/d^2$

where n is the desired sample size, z is the standard error of mean, which is 1.96 at 95% CI (Confidence Interval), p is the prevalence, q corresponds to (1-p) and d is the level of significance (0.05 at 95% CI). To take care of non-response and incompleteness of the questionnaires, 10% of sample size was added (189 +19) to get a sample of 208. Based on the estimated number of persons with diabetes who attend the clinics every month, a proportionate figure was calculated for the number of respondents to be sampled in each of the clinics. The inclusion criteria of the study were as follows: All willing patients with diagnosis of diabetes mellitus type II and those with type I diabetes whose period of illness was more than three years from the date of diagnosis. Exclusion criteria were patients who were mentally unsound and children under the age of 18 because they are legally not allowed to give consent. The patients who met the inclusion criteria were then interviewed at the waiting room before seeing the clinician, by a consecutive sampling technique till the required number was obtained. Quantitative data was collected from the sampled patients in each of the health facilities over a period of two months using an interviewer-administered questionnaire. FGDs (Focus group discussion) and KIIs (Key informant interviews) were used to collect information needed to develop items of the questionnaire. For FGD, two groups each containing six respondents were randomly selected. The FGDs were conducted once every month during their monthly general meeting. The discussions were taped, then transcribed and translated into English. In this study, the Key informants were a clinician and a peer educator randomly drawn by every clinics as they

were the most informed experts about healthcare services delivered by health facility and about health seeking behaviors that could affect their utilization. KIIs were held during the periods in which the informants were not seeing the patients. Authorization to carry out the study was obtained from Kenyatta University and National Commission for Science, Technology and Innovation (NACOSTI). Written (or verbal) consent was obtained from all participants.

Study questionnaire

A questionnaire *ad hoc* was used to collect socio-demographic (age, gender, marital status, occupation, educational and income levels) and clinical data (presence of complications, perceived costs of service, time before diagnosis was made) of participants, level of utilization of diabetic retinopathy screening (‘yes’ or ‘not’), level of knowledge and attitude of study participants concerning their illness and diabetic retinopathy screening. A 10-point Likert scale was used to measure the level of knowledge on diabetes and DR screening. The scores were categorized into ‘poor’ (0-4 points), ‘fair’ (5-6 points) and ‘good’ (7-10 points) knowledge. Frequency and percentages of correct items were also calculated. Attitude was measured using four statements on a five-point Likert scale. The statements were scored as +1 (strongly agree) +2 (agree) +3 (‘I am not sure’ or neutral) +4 (disagree) +5 (strongly disagree). The most correct answer was ‘strongly disagree’. Frequency and percentages of the answers were calculated to determine the most common beliefs and opinions amongst the participants. Validity of the questionnaire was ensured by an expert panel of reviewers on the subject and by trained research assistants to understand the operational definitions of terms and for uniformity in questioning skills. Reliability of the instrument was ensured by pretesting it to 10% of the sample size prior

to actual data collection and by using Cronbach's Alpha test for internal consistency. The alpha coefficient was found to be high at 0.89 meaning the internal consistency in the measurement instrument was high, hence acceptable.

Statistical analysis

The data was managed and analyzed using SPSS version 20. Chi squares tests were used to study the association between categorical variables, where level of utilization of the service ('yes' or 'not') was the dependent variable, whereas the independent variables were socio-demographic data, level of knowledge and attitude, and clinical and health facilities characteristics. Subsequently, significant variables in Chi-square tests ($P < 0.05$) were retained for logistic regressions. Ordinal logistic regression model with stepwise method was used on variables with statistical significance at chi square tests ($P < 0.05$) to determine the significant predictors of diabetic retinopathy screening.

RESULTS

A total of 200 patients (rate of respondents: 96%) participated in the study. The mean age of the participants was 55.5 ± 0.5 years. Most of the participants ($n = 128$, 64%) were female.

Table 1. Socio-demographic and clinic characteristics of the respondents ($n = 200$).

Variable	**N (%)**
Age	
25-39	18 (9.0%)
40-54	84 (42.0%)
55-69	78 (39.0%)
≥ 70	20 (19%)

Gender	
Female	128 (64%)
Marital status	
Married	103 (51.5%)
Single	97 (48.5%)
Occupation	
Employed	41 (20.5%)
Not employed	159 (79.5%)
Education level	
None	65 (32.5%)
Primary	81 (40.5%)
Post primary	54 (24.5%)
Spouse education level	
None	38 (19%)
Primary	85 (42.7%)
Post primary	77 (38.4%)
Religion	
Christian	195 (97.5%)
Muslims	5 (2,5%)
Average monthly Income (USD)	
0-10 (low)	97 (48.5%)
11-50 (medium)	55 (27.5%)
Above 50 (high)	48 (24.0%)
Complications of diabetes (all)	
Yes	149 (74.5%)
No	51 (25.5%)
Utilization of DR screening service (during the last year)	
Yes	21 (10.5%)
No	179 (89.5%)

All the participants had type 2 diabetes. Those who had type 2 diabetes not requiring insulin accounted for 90%, while only 20 participants (10%) had type 2 diabetes requiring insulin

injection. The mean duration of diabetes was 6 years. Slightly more than half (52.5%) of the respondents had history of diabetes in their family and 74.5% of them reported to have diabetes-related complications such as eye problems, hypertension and kidney problems. Those who reported to have suffered from the symptoms of diabetes for a month or more before diagnosis accounted for 80%. More than half (n = 124; 62%) of the participants reported that they could not afford the cost of regular diabetic retinopathy screening, while 76 patients (38%) did not find the cost as a challenge. Those who had been referred for eye screening were 70 (35%), whereas 130 (65%) reported that they had never been referred for screening. On whether distance to the health facilities with diabetic retinopathy screening services was a barrier, 111 (55.5%) respondents answered 'yes'.

Level of utilization of DR screening

As shown in Table 1, only 21 (10.5%) participants (F = 13, M = 8) had undergone screening for diabetic retinopathy within the last 12 months from the time of the study and were assigned to the screened group. The remaining participants (n = 179, 89.5%; F = 115, M = 64) were assigned to the unscreened group. Therefore, the results of this study revealed a low utilization level of diabetic retinopathy screening.

Level of knowledge of DM and attitude towards DR screening

The respondents scored above 50% in most of the questions about knowledge of DM and DR screening. However, their scores on awareness of recommended frequency of screening (15%) and of importance of regular retinal screening (20%) were very poor. Table 2 shows the summary of their response.

Table 2. Summary of correct response on knowledge questions (participants *n* = 200).

Knowledge of DM	**Frequency (%) of correct answers**-
Knowledge of at least 2 complications related to diabetes	55%
Knowledge of risk of damaged eyes due to diabetes	91%
Knowledge of the risk of impaired vision due to DM	91%
Knowledge of at least 3 factors that could increase the severity of DR	74.5%
Knowledge of the prevention measures against vision loss due to diabetes	61.5%
Knowledge of treatment measures against vision loss due to diabetes	55.5%
Knowledge of at least 2 treatment options	35.5%
Knowledge that diabetic patients should sought eye care services	82.5%
Knowledge of the recommended frequency (‘every year’) of eye care visits	15%
Knowledge of the importance of regular DR screening	20%

By categorizing the scores, a third of the participants (*n* = 66, 33%) had ‘good’ knowledge, others had ‘fair’ (*n* = 88, 44%) and ‘poor’ (*n* = 46, 23%) knowledge.

Figure 1. Level of knowledge of DM and DR amongst the participants.

With respect of attitude scores, most of the respondents (n = 72) agreed with the idea that screening is not necessary if blood sugar is controlled. Close to half of the participants (n = 94) were not sure if screening could lead to loss of sight. More than half of them (n = 122, 61%) strongly agreed or agreed that screening is only necessary in case of eye symptoms and 104 (52%) indicated disagreement that DR screening requires physician referral. -

Table 3. Respondents responses on attitude (n = 200).

Statement	**Strongly agree (%)**	**Agree (%)**	**I am not sure (%)**	**Disagree (%)**	**Strongly disagree (%)**
'DR screening is not necessary if my blood sugar is controlled'	35 (17.5)	72(36)	19(9.5)	61(30.5)	13(6.5)

'DR screening is dangerous because it can lead to sight loss'	6 (3)	20(10)	94(47)	75(37.5)	5(2.5)
'DR screening is necessary only in case of eye symptoms'	17 (8.5)	105(52.5)	8(4)	65(32.5)	5(2.5)
'DR screening is necessary only when recommended by a physician'	10 (5)	75(37.5)	6(3)	104(52)	5(2.5)

Predictors of utilization of DR screening

Level of knowledge on DR screening, socio-demographics characteristics, clinical and health facilities factors were associated with DR screening utilization by chi square tests. As shown by Tables 3, 4, and 5, DR screening use was statistically significant associated with occupation ($\chi 2 = 14.758$, df = 1, $P = 0.001$), education level ($\chi 2 = 14.758$, df = 1, $P = 0.001$), education level of the spouse ($\chi 2 = 5.924$, df = 1, $P = 0.027$), average monthly income ($\chi 2 = 24.320$, df = 1, $P = 0.000$), marital status ($\chi 2 = 24.320$, df = 1, $P = 0.000$), family history of diabetes ($\chi 2 = 6.402$, df = 1, $P = 0.019$), presence of symptoms before diagnosis ($\chi 2 = 4.308$, df = 1, $P = 0.000$), clinician referral ($\chi 2 = 13.6$, df = 1, $P < 0.001$) and economic barriers or 'high cost of screening' ($\chi 2 = 7.718$, df = 1, $P < 0.029$).

Table 4. Association between level of knowledge, socio-demographic and economic factors and utilization of diabetic retinopathy screening amongst the participants (n = 200).

Level of knowledge		**DR screening utilization (%)**		
		Yes (n = 21)	**Not (n = 179)**	**P value**
Poor knowledge Fair knowledge Good knowledge		5 (10.8) 11 (12.5) 5 (7.6)	41 (89.2) 77 (87.5) 61 (92.4)	$\chi2$ = 0.930 df = 2 P = 0.628
Socio demographic variables		**DR screening utilization (%)**		**P value**
		Yes (n =21)	**Not (n = 179)**	
Age	25-39 40-54 ≥55	5 (26.3) 9 (10.8) 7 (7.1)	14 (73.7) 74 (89.2) 91 (92.9)	$\chi2$ = 2.944 df = 2 P = 0.400
Gender	Male Female	11 (15.3) 10 (7.8)	61 (84.7) 118 (92.2)	$\chi2$ = 24.654 df = 1 P = 0.181
Occupation	Employed Not employed	12 (29.3) 9 (5.6)	29 (70.3) 150 (94.3)	$\chi2$ = 14.758 df = 1 P = 0.001*
Education level	Primary and below Post primary	7 (4.8) 14 (25.9)	139 (95.2) 40 (74.1)	$\chi2$ = 14.758 df = 1 P = 0.001*
Education level of spouse	Primary and below Post primary	5 (8.1) 11 (27.5)	57 (91.9) 30 (52.5)	$\chi2$ = 5.924 df = 1 P = 0.027**
Average monthly income (USD)	0-50 51 and above	5 (3) 16 (34)	148 (97) 31 (66)	$\chi2$ = 24.320 df = 1 P = 0.000*
Occupation of spouse	Employed Not employed	7 (28) 9 (11.5)	18 (72) 69 (88.5)	$\chi2$ = 5.954 df = 2 P = 0.051
Marital status	Married Single	16 (15.5) 5 (5.2)	87 (84.5) 92 (94.8)	$\chi2$ = 24.320 df = 1 P = 0.000*
Religion	Christian Muslim	20 (10.3) 1 (20)	175 (89.7) 4 (80)	$\chi2$ = 0.899 df = 1 P = 0.638

Notes: *P < 0.01, ** P < 0.05

Table 5. Association between clinical factors and utilization of diabetic retinopathy screening amongst the participants (n = 200).

Clinical variables		**DR screening utilization (%)**		**P value**
		Yes (n = 21)	**Not (n = 179)**	
Family history of diabetes	Yes No	5 (4.8) 16 (16.8)	100 (95.2) 79 (83.2)	$\chi2$ = 6.402 df = 1 P = 0.019**
Duration of diabetes	5. yrs > 5 yrs	11 (9.8) 10 (11.4)	101 (90.2) 78 (88.6)	$\chi2$ = 0.085 df = 1 P = 0.801
Complications of diabetes	Yes No	15 (10.0) 6 (11.8)	134 (90.0) 45 (88.2)	$\chi2$ = 0.143 df = 1 P = 0.770
Presence of symptoms before diagnosis	Yes No	12 (30) 9 (5.6)	28(70) 151 (94,4)	$\chi2$ = 4.308 df = 1 P = 0.000*
Type of diabetes therapy	Oral hypo+diet Insulin+Oral Hypo+diet	16 (8.9) 5 (25)	164 (91.1) 15 (75)	$\chi2$ = 6.238 df = 3 P = 0.101

Notes: *P < 0.01

Table 6. Association between health facility factors and Diabetic Retinopathy screening utilization (n = 200).

Health facility variable	**Category**	**DR screening utilization (%)**		**Significant p value**
		Yes (n = 21)	**Not (n = 179)**	
Primary care clinician referral	Not, referred Yes, referred	6 (4.6) 15 (21.4)	124 (95.4) 55 (78.6)	$\chi2$ = 13.6 df = 1 P < 0.001*
Economic barriers (High cost of screening)	Affordable Not affordable	6 (7.9) 15 (12.1)	70 (92.1) 109 (87.9)	$\chi2$ = 7.718 df = 1 P < 0.029**
Distance between residence and healthcare facilities	Accessible Inaccessible	11 (52.4) 10 (47.6)	100 (55.9) 79 (44.1)	$\chi2$ = 0.056 df = 1 P = 1.000

Notes: *P < 0.01, ** P < 0.05

Table 7. Predictors of utilization of diabetic retinopathy screening by logistic regression models.

Variable	*Est*	*Std error*	*Wald*	*Exp B*	*95% Confidence interval*		*Sig (p-value)*
					Lower	*Upper*	
Intercept	0.956	2.409	0.158	_	_	_	0.691
Education level	1.484	1.107	1.797	4.411	1.504	28.636	0.018
Family History of diabetes	2.408	1.004	5.757	11.112	1.554	59.444	0.016
Clinician referral	1.183	0.959	1.522	3.263	1.498	21.357	0.027

As shown in Table 7, the exponential beta (Exp B) gives the odds ratio (OR) of utilization of diabetic retinopathy screening showing some significant predictors such education level, presence of family history of diabetes and primary clinician referral. The results showed that those who had post primary level of education were four times likely to use diabetic retinopathy screening compared to those who had lower educational level [(OR = 4.411; 95% Confidential Interval (CI) 1.504 to 28.636; *P* = 0.018)]. Moreover, respondents reporting history of diabetes were 11 times not likely to be screened within the last year compared to those who didn't have family history of diabetes (OR = 11.112; CI 1.554 to 59.444; *P* = 0.016). Finally, those who had been referred for eye screening by primary care clinicians were 3 times more likely to be screened compared to those who had not been referred (OR = 3.263, CI 1.498 to 21.357; *P* = 0.027).

DISCUSSION AND CONCLUSIONS

Level of utilization of DR screening

In this study, the level of utilization of diabetic retinopathy screening by the participants was found to be very low, with no significant difference between male and female. This finding is in agreement with a study carried out by Mwangi et al. in three counties in Kenya, where only 13.3% of the participants had been screened during the previous year [12]. It also concurs with a study carried out in Qatar where only 4.8% of the participants were found to be attending the diabetic retinopathy screening [13]. This finding, however, contradicts a study carried out in Ireland, which reported 81% of participants having undergone dilated eye examination within a year [14], showing a high utilization of this service. Probably, this could be attributed to the different healthcare coverage enjoyed in most of the developed countries, Ireland being one of them.

Level of knowledge of DM and attitude of diabetic patients towards their illness and utilization of DR screening

Results of this study showed no significant relationship between level of knowledge and utilization of screening service for diabetic retinopathy ($P > 0.05$). This finding correlates with a study carried out in Qatar, which found no association between level of knowledge and attendance of diabetic retinopathy screening [13], yet it partly contradicts a past study carried out in three counties in Kenya, which reported the level of knowledge of diabetes complication as a predictor of DR screening [12]. It should, however, be noted that despite the fact that many participants in our study had a fair level of knowledge as shown by several knowledge questions, majority of them (80%) were either unaware of the recommended screening interval or of the

importance of regular screening. As a consequence, patients cannot adhere to a recommendation they are not aware of. The results of this study concur with findings of past studies conducted in the region, for instance a research conducted in Embu, showing that more than 70% of the participants cited lack of awareness as a barrier to DR screening [7]. In Africa, a Tanzanian study showed 76.6% of participants reporting lack of awareness of DR screening importance as a major barrier to its utilization [15]. With regard to the attitude, in our study slightly more than half (54%) of the participants thought that control of blood sugar was by itself enough to avoid going for eye screening. An even bigger percentage (61%) believed that eye screening should be driven by symptoms. These are misconceptions that can contribute to delay in eye examination and treatment, which in turn lead to visual impairment. Educational messages should be geared towards raising awareness of the recommended interval of DR screening and the importance of adhering to this recommendation. This may also help in changing both the patients' and health professional's attitudes towards diabetic retinopathy screening.

Predictors to utilization of DR screening

Among socio-demographic factors, in our study level of education showed a significant relationship with the utilization of DR screening. More specifically, those with post-primary educational level had an increased likelihood of being screened compared to those who had primary or no formal education. Previous studies pointed to the importance of education on influencing regular health service utilization, correct interpretation of signs and symptoms and compliance to treatment regime. Similar findings have been documented in study by Paksin-Hall et al, where educational level was found to be a significant determinant of annual eye

examination. These findings, however, disagreed with a study carried out in Qatar, which reported no correlation between level of education and attendance of diabetic retinopathy screening [13]. In our study, occupation and average monthly income, which can be considered as indicators of economic status, were not relevant predictors for uptake of diabetic retinopathy screening. This could be also attributed to the fact that majority of the participants were not aware of the recommended frequency of eye examination, and they were therefore unlikely to be aware of economic impact of regular eye screening.

Having family history of diabetes increases the chances of being screened by 11 times. Family members tend to have similar health seeking behaviors. Therefore, the knowledge on the importance of frequent diabetic retinopathy screening could have a positive influence on the utilization of screening. Probably, persons with familial history of diabetes may tend to seek healthcare services earlier. This finding also suggests that main source of information for these patients remains their family, rather than health professionals. In this essence, family members of PLWD should also be a target population for education on the importance of regular eye examinations to enhance the effectiveness of educational training. Clinician referral also was found to be an important predictor of diabetic retinopathy screening. The respondents who had been referred by primary care clinicians were three times likely to be screened within a year compared to those who had not been referred. This is in agreement with a study by Mwangi et al, which reported patient referral for screening as a strong predictor for annual eye screening [12]. The role of lack of provider recommendation for screening has also been documented in studies carried out in Nigeria [17] and China [18]. Empowering PLWD for self-referral through interventional programmes might also increase the uptake of screening.

Study limitations

This study had several limitations**.** First, being a facility-based study, the finding could not be generalized to persons affected by diabetes who do not attend the diabetes services. Moreover, there is a possibility of sampling bias as the study was conducted in public health centres, which are mostly attended by lower economic class because of their affordability. Moreover, self-reported data was used in the study, which is prone to recall bias.

Recommendations for policymakers

In Kenya, the government should introduce eye screening services in all 'level three' health facilities to ensure that the diabetic patients who attend these clinics are regularly screened as well as the policymakers should improve their accessibility and utilization. The government should also raise a more comprehensive and aggressive awareness campaign on diabetes retinopathy. Educational messages should focus on the recommended interval for eye examinations, importance of regular diabetic retinopathy screening and empowering PLWD to request/demand for eye examination. Target population should include PLWD, their families, health care providers and the general public. Re-education of diabetes clinicians on the importance of appropriate referral of patients for diabetic retinopathy eye examination is also important. Distributing and re-distributing of clinical decision-making tools such as DR screening guidelines in facilities at regular intervals could be useful to ensure they are always available for reference [12]

CONCLUSIONS

Our study showed that in Kenya it is likely that there is a low level of utilization of diabetic retinopathy screening among PLWD. Moreover, there is poor knowledge by these patients on the recommended frequency of diabetic retinopathy screening. Finally, PLWD showed a poor attitude towards DR screening utilization, which could be attributed to insufficient knowledge on the importance of regular retinal examination. The significant predictors to utilization of diabetic retinopathy screening, in our study, were high educational level, presence of family history of diabetes and primary clinician referral. These factors, therefore, could influence the utilization of this service by PLWD and should be taken into consideration by educational campaigns.

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