

Knowledge of diabetes and its associated ocular manifestations by diabetic patients: A study at Korle-Bu Teaching Hospital, Ghana

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ABSTRACT

Background: Diabetes mellitus is a significant cause of visual impairment, hence adequate knowledge on this condition and its ocular manifestations is of immense importance to diabetic patients. **Aim:** To assess the knowledge of diabetic patients on the disorder and its ocular manifestations, and their attitude towards ocular examinations. **Materials and Methods:** A cross-sectional survey involving the use of a structured interview was conducted among diabetic patients attending the Diabetic Clinic of the Korle-Bu Teaching Hospital. Using Fishers Exact Chi-square (χ^2) and Odds Ratios (ORs), data obtained was analyzed. **Results:** Only 103 (26.4%) patients knew the type of diabetes mellitus they were suffering from. Knowledge on ocular effects of diabetes mellitus was low and only 15 (3.8%) knew that it could affect the ocular refraction with no patient mentioning that diabetes mellitus could cause cataract or diabetic retinopathy. Attitude to routine eye examination was poor. As much as 135 (34.6%) had never had an eye examination since being diagnosed of diabetes. Knowledge of the type of diabetes mellitus the individual had or any ocular complication of this disorder was significantly related (OR: 4.22; $P < 0.001$ and OR: 2.55; $P < 0.001$) respectively to their attitude to seeking eye care. **Conclusion:** Diabetic patients' knowledge on diabetes mellitus and its ocular manifestations, and the attitude of diabetic patients towards eye examination were poor. Intensive health education by diabetes care givers and leaders of the Ghana Diabetic Association for diabetic patient is therefore required to improve attitude towards eye care to prevent visual impairment.

Key words: Cataract, diabetes mellitus, diabetic retinopathy, ocular manifestations

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INTRODUCTION

Diabetes mellitus (DM), a multi-systemic disease characterized by hyperglycemia, is on the increase worldwide. The prevalence of DM was estimated at 171 million in 2000 and future projections made to the next three decades indicate that this prevalence could reach 366 million with developing countries being the most affected.¹ Report indicate that in the year 2000, there were 7.5 million cases of DM in Africa with more than 80% of these cases remaining undiagnosed.²

According to the International Diabetes Federation over 7.1 million people in sub-Saharan Africa are now estimated to suffer from DM and this will increase to 15.0 million by 2025.³

Diabetes used to be very uncommon some decades ago with estimates ranging from 0.2 to 0.4% in Ghana.⁴⁻⁶ This situation is steadily changing as diabetes now accounts for 6.8% adult admissions at the Korle-Bu Teaching Hospital in Accra, Ghana.⁷ This estimate is close to the finding of a population-based survey in Accra which recorded a prevalence of 6.3% among subjects aged 25 years and older.⁸ President of the National Diabetes Association gave a current estimate of the diabetic population in Ghana to be more than 4 million.⁹ This increase in prevalence could be attributed to several risk factors including ageing, diet, obesity and physical inactivity.¹⁰

Diabetic patients suffer systemic complications including ocular disorders. It is estimated that 4.51 million of the

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diabetic population in sub-Saharan Africa have one form of ocular complications due to diabetes.¹¹ People living with diabetes are about 25 times more likely of becoming blind compared to the normal population.¹² The incidence of vision loss or blindness due to ocular complications of diabetes raises sufficient public health concern, with diabetic retinopathy alone responsible for 12,000 to 24,000 new cases of blindness yearly in the United States.¹³ Some other known causes of blindness secondary to diabetes are cataracts, glaucoma, nerve palsies and macular degeneration.¹⁴

Diabetic patients are required (due to the disposition of their condition) to have sufficient knowledge regarding their illness so as to exhibit a positive attitude to health care. Despite the increased tendency of blindness, studies have shown that most diabetic patients do not seek the recommended ocular examinations (such as regular dilated fundus examination) aimed at preventing visual impairment and blindness.¹⁵ It is therefore very essential that patients' knowledge on the ocular manifestations of diabetes be ascertained to determine if this is the barrier to seeking recommended eye examination among the diabetic population in Ghana. This study therefore evaluated the knowledge that diabetic patients had concerning ocular manifestations of diabetes mellitus and their attitude towards ocular examination. This will aid diabetes care givers and the Ghana Diabetic Association to provide counseling and conduct health educational programmes.

MATERIALS AND METHODS

Study area

This study was carried out in the Diabetes Clinic of the Korle-Bu Teaching Hospital (KBTH), Accra, Ghana. It serves as the center for National Diabetes Management and Research.

Study population

The study population comprised DM patients aged 16 years and above who attended the Diabetes Clinic and consented to participate in the study. A total of 390 diabetic patients were recruited for the study. The figure meets the minimum sample requirement for a study population greater than 10,000 based on the formula below.¹⁶

$$n = Z^2 P(1-P)/d^2$$

n = the desired sample size (when population is greater than 10,000)

z = the standard normal deviate, usually set at 1.96, which corresponds to the 95% confidence interval

P = proportion in the target population estimated to have a particular characteristic (50%)

d = degree of accuracy.

Ethical considerations

Institutional approval to conduct the study was sought and obtained from the Department of Optometry, University of Cape Coast, Cape Coast, Ghana, and the National Diabetes Management and Research Center (NDMRC), Korle-Bu Teaching Hospital, Accra, Ghana. Informed consent was administered and only those who gave consent were recruited to participate in the study. The study was conducted in accordance with the World Medical Association Declaration of Helsinki on the ethical principles for medical research involving human subjects.

Study conduct and design

A prospective cross-sectional survey was conducted over a three-month period, among the DM patients. Each patient was given an interview guide and assisted by an interviewer to respond to questions in the guide. The interviews were conducted by one of the authors (SA) and five trained research persons from NDMRC. Participants responded to questions in; basic demographic information of patient (age, sex, location, occupation, education, onset and duration of the disease), patients' knowledge of their diabetic status, knowledge on the ocular manifestations of diabetes, and practices towards eye examination. The interview was conducted in the language that the participant understood and could communicate well with the interviewer.

Patients were categorized based on their knowledge on diabetes and/or ocular manifestations of diabetes: "Knowledge present" -comprised those who gave the right response and "Knowledge absent"-comprised those without the appropriate response. Also, patients that had undergone ocular examination were regarded as having "positive practice" while those without any eye examination since diagnosis of diabetes were labeled as having "negative practice".

Data analysis

The Statistical Package for social sciences (SPSS) version 17 was used for the computation. Descriptive statistics including frequencies, percentages, means and standard deviations were computed. The Fisher's Exact Chi-square (χ^2) test was used in determining statistically significant differences in demographic characteristics between male and female diabetic patients. Odds ratios were also computed to determine the relationship between patient's knowledge on diabetes and its ocular effects and their practices regarding eye examination. Binary logistic regression was also used to assess the effects of other demographic characteristics on patient's knowledge.

RESULTS

Demographics

Of the 390 diabetics that volunteered to participate in the study, 299 (76.7%) were females while 91 (23.3%) were

males (M: F = 1:3.3). The mean age of the participants was 56.98 ± 12.93 years (95% CI = 55.70 – 58.26 years). The mean duration of diabetes mellitus was 8.69 ± 6.14 years (95% CI = 8.08 – 9.30 years); males had a significantly lower ($P = 0.033$) duration [Table 1].

Most of the patients ($n = 206$) were traders (of whom 186 [90.3%] were women), while farmers ($n = 5$) and the “professionals ($n = 90$)” were mainly men. Gender was significantly ($P < 0.001$) associated with the diabetic patient’s occupation. In relation to formal education, 288 (73.8%) had either basic education or above, while 102 (26.2%) did not have any formal education. Males were more educated with only five (4.9%) having no formal education. A strong association ($P < 0.001$) existed between gender and education [Table 1].

Knowledge of types of DM

Regarding diabetic patient’s knowledge on the type of diabetes they had been diagnosed of, only 103 (26.4%) had knowledge of their DM status. Of these 18 (4.6%) had type I, 77 (19.7%) had type II and eight (2.1%) had gestational diabetes [Table 2]. Although females were less knowledgeable of their status, gender ($P = 0.345$) was not significantly related to patient’s knowledge on the type of diabetes being suffered [Table 3].

With regards to age, 93 (90.3%) of those with knowledge on type of DM ($n = 103$) were above 40 years, with those older than 80 years having more knowledge compared to all other age groups. The age of the patients was not significantly related ($P = 0.788$) to the individuals knowledge on type of DM [Table 3].

Table 1: Demographic characteristics of DM patients involved in the study

Characteristic	Male (n=91)	Female (n=299)	P value	Characteristic	Male (n=91)	Female (n=299)	P value
Age (yrs) (%)				Duration of DM (yrs) (%)			
≤40	11 (22.4)	38 (77.6)	0.729	≤10	70 (26.2)	197 (73.8)	0.036*
41-60	40 (21.3)	148 (78.7)		11-20	15 (14.4)	89 (85.6)	
61-80	38 (26.4)	106 (73.6)		>21	6 (31.6)	13 (68.4)	
>80	2 (22.2)	7 (77.8)		Mean±SD	7.48±6.36	9.05±6.04	
Mean±SD	58.11±12.93	56.64±12.94	0.343	Level of education (%)			
Occupation (%)				Basic	38 (25.2)	113 (74.8)	<0.001***
Trader	20 (9.7)	186 (90.3)	<0.001***	Post-basic	48 (35.0)	89 (65.0)	
Artisan	16 (33.3)	32 (66.7)		None	5 (4.9)	97 (95.1)	
Farmer	4 (80.0)	1 (20)					
Professionals	46 (51.1)	44 (48.9)					
Unemployed	5 (12.2)	36 (87.8)					

DM – Diabetes mellitus

Table 2: Relationship between diabetic patient’s knowledge (regarding diabetes its ocular manifestations) and practice towards eye examination

Knowledge	n (%) n=390	Practices towards eye examination	n (%)	Knowledge	Eye exam (+) (%)	Eye exam (-) (%)	OR (95% CI)	P value
Type of DM		Eye exam (n=390)		Type of DM				
Type I	18 (4.6)	Positive	255 (65.4)	Present	88 (34.5)	15 (11.1)	4.22 (2.32-7.65)	<0.001***
Type II	77 (19.7)	Negative	135 (34.6)	Absent	167 (65.5)	120 (88.9)		
Gestational	8 (2.1)	DFE (n=255)		Effect of DM				
Was not told	287 (73.6)	Yes	181 (46.4)	Present	220 (86.3)	96 (71.1)	2.55 (1.53-4.28)	<0.001***
Effect of DM		No	209 (53.6)	Absent	35 (13.7)	39 (28.9)		
Affects vision	191 (49.0)	Freq exam (n=255)						
Affects the health	64 (16.4)	Every 6 months	57 (22.4)					
Can make you blind	123 (31.5)	Every 12 months	19 (7.5)					
Affects glass prescription	15 (3.8)	Every 24 months	11 (4.3)					
No idea	74 (19.0)	If vision is poor	168 (65.8)					

DM – Diabetes mellitus; DFE – Dilated fundus examination; eye exam (+) – Eye examined after diagnosis; eye exam (-) – Eye not examined after diagnosis; OR – Odds ratio; CI – Confidence interval

Table 3: Multivariate analysis of diabetic patient's knowledge and attitude regarding diabetes and the ocular manifestations

Demographic characteristic	Knowledge of type of DM (n=103) (%)	OR (95% CI)	P value	Demographic characteristic	Knowledge of effect of DM (n=316) (%)	OR (95% CI)	P value
Gender				Gender			
Male	35 (34.0)	1.00		Male	67 (21.2)	1.00	
Female	68 (66.0)	0.75 (0.42-1.36)	0.347	Female	249 (78.8)	2.57 (0.99-6.69)	0.054
Age			0.788	Age			0.249
≤40	10 (9.7)	0.58 (0.11-3.21)	0.533	≤40	35 (11.1)	<0.001	0.999
41-60	52 (50.5)	0.85 (0.18-4.09)	0.838	41-60	158 (50.0)	<0.001	0.999
61-80	38 (36.9)	0.73 (0.15-3.52)	0.691	61-80	117 (37.0)	<0.001	0.999
>80	3 (2.9)	1.00	-	>80	6 (1.9)	1.00	-
Duration of DM			0.721	Duration of DM			0.292
≤10	67 (65.1)	0.73 (0.23-2.32)	0.593	≤10	209 (66.1)	2.13 (0.51-8.96)	0.302
11-20	30 (29.1)	0.89 (0.27-2.93)	0.849	11-20	91 (28.8)	3.85 (0.71-20.96)	0.120
>20	6 (5.8)	1.00	-	>20	16 (5.1)	1.00	-
Level of education			<0.001	Level of education			0.303
Basic	38 (36.9)	3.18 (1.42-7.15)	0.005	Basic	128 (40.5)	0.83 (0.29-2.43)	0.736
post-basic	56 (54.4)	5.69 (2.48-13.04)	<0.001	post-basic	115 (36.4)	1.79 (0.51-6.31)	0.363
None	9 (8.7)	1.00	-	None	73 (23.1)	1.00	-
Occupation			0.370	Occupation			0.734
Trader	39 (37.9)	0.53 (0.24-1.20)	0.127	Trader	171 (54.1)	2.14 (0.63-7.27)	0.221
Artisan	11 (10.7)	0.53 (0.19-1.47)	0.225	Artisan	41 (13.0)	2.78 (0.56-13.76)	0.210
Farmer	2 (1.9)	0.95 (0.12-7.55)	0.964	Farmer	5 (1.6)	<0.001	0.999
Professional	39 (37.9)	0.90 (0.37-2.20)	0.812	Professional	70 (22.2)	1.62 (0.37-7.03)	0.519
Unemployed	12 (11.7)	1.00	-	Unemployed	29 (9.2)	1.00	-

DM – Diabetes mellitus; OR – Odds ratio; CI – Confidence interval

Of the 103 patients who had knowledge of the type of DM they had, 67 (65.1%) were diagnosed less than 10 years ago and were the least to know about the type of DM (OR: 0.73) though patient's duration of DM had no significant ($P = 0.721$) association with the individual's knowledge on the type of DM [Table 3].

The patient's level of formal education was significantly related ($P < 0.001$) to the individuals knowledge of the type of DM. Patients with post-basic education being most knowledgeable (OR: 5.69) of the type of DM suffered [Table 3]. Traders 39 (37.9%) and professionals 39 (37.9%) constituted the majority who were knowledgeable of the type of DM they had, but patient's occupation was not significantly related ($P = 0.370$) to the knowledge of the type of DM [Table 3].

Knowledge on ocular effects of DM

Regarding the knowledge on the ocular effects of DM, 74 (19.0%) had no idea of any specific ocular effect of DM but 191 (49%) reported it could affect vision. Only 15 (3.8%) knew that DM could affect the patient's ocular refractive state (i.e., their spectacle correction) [Table 2].

Of the 316 who had knowledge of some ocular effects of DM, 249 (78.8%) were females indicating that they were slightly more knowledgeable ($P = 0.054$) on some ocular effects of diabetes than males [Table 3].

Although patient's age was not significantly related ($P = 0.249$) to the knowledge on the ocular effects

of diabetes, those older than 80 years were comparatively more knowledgeable [Table 3].

While majority of patients (209 (66.1%)) with knowledge of some ocular effects of DM had had diabetes for 10 years or less, patients with DM ranging from 11 to 20 years were most knowledgeable (OR: 3.85). Patient's duration of diabetes was, however, not significantly related ($P = 0.292$) to the knowledge on the ocular effects of diabetes [Table 3].

Most of the diabetic patients (243 (76.9%)) who were knowledgeable on some ocular effects of DM had had basic education or more. Although patient's level of formal education was not significantly ($P = 0.303$) associated with the individuals knowledge of the ocular effects of DM, patients with post-basic education were more knowledgeable (OR: 1.79; $P = 0.363$) compared to those without basic education [Table 3].

Even though traders constituted more than half of the individuals with knowledge on the ocular effects of diabetes, this was not statistically different (OR: 2.14; $P = 0.221$) from other occupations. Patient's occupation was not a statistically significant determinant ($P = 0.734$) of the individuals knowledge regarding the ocular effects of diabetes [Table 3].

Diabetic patient's practices towards eye examination

Among the 390 participants, 255 (65.4%) reported having had an eye examination after being diagnosed of diabetes,

of which only 181 (46.4%) underwent dilated fundus examination. When these patients who had undergone eye examination were asked how frequently they examined their eyes, majority 168 (65.85%) indicated that they only examined their eyes if their vision got poor [Table 2].

Relationship between knowledge and practices of diabetic patients

Of the 255 patients that had their eyes examined, 88 (34.5%) were those who were knowledgeable on the type of DM diagnosed [Table 2]. A statistically significant association existed between knowledge of the type of diabetes diagnosed and ocular examination, with diabetic patients knowing the type of DM suffered being more likely (OR: 4.22; $P < 0.001$) to undertake an eye examination [Table 2].

Also, among the 255 patients that had eye examination after diagnosis, 220 (86.3%) were knowledgeable on the ocular effects of DM. Knowledge of ocular effect of DM was significantly related to eye examination with those having knowledge on the ocular effects of DM being more likely to undertake eye exam (OR: 2.55; $P < 0.001$) [Table 2].

Information on eye care providers consulted, source of eye education, relatives with DM, DM treatment and hypertensive status.

Concerning the sources of education on the ocular effects of DM, most patients (210 (66.4%)) obtained their knowledge from general practitioners and nurses with only 26 (8.2%) having obtained this knowledge from optometrists [Table 4].

Of the 255 who have had their eyes examined at least once after diagnosis of DM, most of these patients reported having been examined by ophthalmologist (151 (59.2%)) and optometrists (129 (50.6%)) with nine (3.5%) not knowing which practitioner did the examination.

Some diabetic patients 217 (55.6%) had one or more relatives also suffering from DM, with 115 (26.9%) having parents with DM and 82 (21.0%) having siblings with DM.

Management of diabetic patients usually involved a combination of treatment options with 289 (75.7%) being

treated with oral medications, 133 (34.8%) on insulin injections and/or diet and exercise 125 (32.7%).

Regarding the association between diabetes and hypertension, 221 (56.7%) of the diabetic patients also had systemic hypertension.

DISCUSSION

Diabetes mellitus is a significant cause of visual impairment among its sufferers. Therefore, sufficient knowledge concerning diabetes and its ocular manifestations as well as good practices with regards to controlling their diabetes and taking the recommended eye examination are crucial. Our study showed that patients had little knowledge of the ocular complications of diabetes. The type of diabetes an individual suffers determines the period of onset of ocular complications. Literature estimates that about 25% of sufferers of non-insulin dependent (type II) diabetes develop some degree of diabetic retinopathy before diagnosis of diabetes is made.^{17,18} No patient mentioned cataract or diabetic retinopathy as ocular disorders that could be caused by DM. Contrary to our findings, a study by Khandekar *et al.*¹⁹ found that 72.9% diabetic patients in Oman were knowledgeable on the ocular complications of DM. Other studies²⁰⁻²¹ have even found over 95% of their study population being knowledgeable on DM and its ocular effects.

Coincidentally, the patients in our study also exhibited poor practices with regards to eye examination with only 19.5% having undertaken last ocular examination within one year with 34.6% never having had an eye examination since being diagnosed of DM. This negative practice towards eye examination and poor knowledge of ocular complications of DM may be attributed to the work overload of the few diabetic practitioners thereby reducing the contact time spent on attending to the needs of each patient. Practitioners lack sufficient time to educate patients on the need to take eye examination as was observed with more than half of the patients reporting not having been advised on taking periodic eye examination. It is recommended that diabetic patients undergo a comprehensive eye examination at least annually to facilitate early diagnosis

Table 4: Information on eye care providers consulted, source of eye education, relatives with DM, DM treatment and hypertensive status

Source eye education (n=316)	n (%)	Eye care providers (n=255)	n (%)	Relatives with DM (n=390)	n (%)	Treatment for DM (n=382)	n (%)	Presence of hypertension	n (%)
Gen practitioner	130 (41.1)	Gen practitioner	13 (5.1)	Parent	105 (26.9)	Tablets	289 (75.7)	Yes	221 (56.7)
Gen nurse	80 (25.3)	Ophth nurse	24 (9.4)	Sibling	82 (21.0)	Insulin inject	133 (34.8)	No	169 (43.3)
Optometrist	26 (8.2)	Optometrist	129 (50.6)	Ext family	25 (6.4)	Diet/exercise	125 (32.7)		
Ophthalmologist	68 (21.5)	Ophthalmologist	151 (59.2)	Child	26 (6.7)	Monitoring	6 (1.6)		
Others	70 (22.2)	Optician	6 (2.4)	None	173 (44.4)	Trad med	3 (0.8)		
		Don't know	9 (3.5)						

DM – Diabetic mellitus; gen – General; Ophth – Ophthalmic; Ext – Extended; inject – Injection; Trad med – Traditional medicine

and management of ocular disorders associated with DM to avoid severe visual impairment.²² A study conducted in Durban, South Africa, found that about 48% of the diabetic patients had undergone an eye examination over one and half year ago.²³ Their patients, therefore, had better attitude towards ocular examination than our study population. The reason for the low uptake of eye care among our study population compared to the participants in the Durban study could be due to the poor knowledge exhibited by our patients. A study of diabetic patient's compliance in assessing eye care at a Tanzanian referral hospital also observed that 28.8% of their patients had received ocular examination within the past year.¹⁵ This negative attitude to eye care in our participants could be due to the very low level of knowledge (on diabetes or its ocular effects) exhibited as we observed a very strong association ($P < 0.001$) between patient's knowledge and attitude to eye care. This supports a study conducted by Hartnett *et al.*²⁴ to assess the barriers to uptake of eye examination among diabetic patients which cited lack of patient education and knowledge about DM as the most significant hindrance.

The association between diabetes and gender has been controversial, while some studies have found increased preponderance for one particular sex; others have found no gender predilection in the prevalence of diabetes. In our study, a huge proportion of patients were women. This might be due to the non-randomization of the study population. In hospital survey of this nature, only patients presenting at the time of the study and giving consent to participate were recruited. Thus we cannot on the basis of the preponderance of female in our study assert that sex is a risk factor for DM.

Also, Omar *et al.*²⁵ observed in their study that the prevalence of DM was more than twice in women than men of Zulu descent in Durban. Obesity is a very important health issue as it has been identified as the underlying risk factor in most chronic non-communicable diseases, especially diabetes. Studies have shown that the prevalence of obesity in Ghanaian women is three times that in men.^{26,27} Therefore, obesity could be the confounding variable establishing the seeming relationship between gender and diabetes.

The mean age of onset of diabetes among the patients was after the fourth decade of life. The significantly lower duration of diabetes in males could be a reflection of the comparatively lower life expectancy among Ghanaian men compared to women.²⁸

Among the diabetic patient's demographics, only the level of patient's formal education significantly influenced the individual's knowledge of the type of DM suffered. This may be due to the difficulty of expressing this information on the various types of DM to uneducated patients or

that this information seems to be incomprehensible to patients without formal education. Conversely, knowledge on the ocular effect of DM was not related to the level of patient's formal education. This implies that no specific education-dependent strategy is required to be employed in the counseling and creating of patient awareness on the ocular manifestations of diabetes.

Diabetic patients are usually more conscious of their general health and therefore more frequently visits their primary diabetic physicians. This may be the reason why most of these patients cited general physicians as source of knowledge on ocular effects of DM. General Physicians due to their regular contact with diabetic patients could do more in educating patients on the ocular complications of DM and the need to adopt the right attitude to eye examination.

Due to the numerous risks of diabetics developing ocular complications, these patients usually require services of trained eye care professionals to attend to their needs. Ophthalmologists and optometrist are required to conduct comprehensive examination including dilated fundus examination (DFE) to aid in early detection and prevention of ocular complications. According to our study, the expertise of these two eye care providers is almost equally utilized in the management of ocular health disorders of diabetic patients.

The family history of diabetes has been a suggested screening tool for assessing the risk of diabetes as it signifies the genetic susceptibility of an individual, especially first degree relatives.²⁹ Several studies indicate that persons with relatives suffering from DM were between 2 to 6 times more susceptible to develop DM.³⁰ Our study supports this assertion as more than 20% of respondents reported having either parents or siblings suffering from DM.

Literature indicates an association between diabetes and hypertension.³¹ This may be because diabetes mellitus as well as cardiovascular diseases share common risk factors and also either one of these disease entities could precipitate the occurrence of the other.³² This study indicated that more than half of the diabetic population also suffered from hypertension. Blood pressure monitoring and control, therefore, should be a routine in the management of all diabetic patients.

CONCLUSIONS

Diabetic patient's knowledge on the type of diabetes suffered and its ocular complications were poor. Patient's knowledge was significantly related to their attitude towards receiving ocular examination. Intensive diabetic patient education from diabetic care givers is therefore required to improve their eye care attitude to prevent visual impairment.

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