

# Sociodemographic factors responsible for blindness in diabetic Egyptian patients

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**Purpose:** To evaluate factors behind the delay in diagnosis and treatment among Egyptian patients who present with complicated diabetic retinopathy.

**Methods:** Observational cross-sectional study of diabetic patients with advanced diabetic retinopathy. Patients were asked to answer a questionnaire to assess the impact of several sociodemographic factors.

**Results:** A total of 397 patients agreed to take the questionnaire. Diabetic vitreous hemorrhage was the most common ocular complication and was found in 359 patients (90.4%). A total of 158 (39.8%) patients knew that diabetes mellitus can be sight threatening, while 240 (60.2%) were not aware until they developed sight threatening complication. A total of 179 patients (45.1%) had early retirement because of visual loss related to diabetes mellitus. Multivariate logistic regression has shown that education, internist, contact with other patients, and media were respectively significant in predicting the awareness of patients about the sight-threatening effect of diabetic retinopathy.

**Conclusion:** Patient education regarding diabetes and diabetic eye disease is essential for early detection and compliance with treatment. Illiteracy has a significant impact on development of sight-threatening diabetic complications. The internist is the first line of prophylaxis. Media has to participate more in patient education.

**Keywords:** blindness, education, laser photocoagulation, macular edema, vitreous hemorrhage

## Introduction

Diabetes mellitus is an increasing health problem that currently affects more than 150 million people worldwide and is expected to affect more than 200 million people by the year 2025.<sup>1</sup> Diabetes mellitus is a chronic metabolic multisystem disease. Complications from diabetes can be classified as microvascular or macrovascular. Microvascular complications include system damage as diabetic peripheral neuropathy, renal nephropathy, and diabetic retinopathy. Macrovascular complications include cardiovascular disease and stroke, and peripheral vascular disease, which may lead to diabetic foot, gangrene, and amputation.<sup>2</sup>

Herman et al<sup>3</sup> found that diabetic retinopathy accounted for about 42% of diabetic patients in Egypt; however, the study done by Macky et al<sup>4</sup> found the incidence to be 20.5%. This improvement could be attributed to early detection of diabetic patients, with better medical care.<sup>3,4</sup> The duration of diabetes remains the most significant predictor of visual impairment among people with type II diabetes.

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Visual loss in diabetic patients is often a late symptom of advanced diabetic retinopathy, with serious undesirable consequences affecting the health and vision-related quality of life.<sup>5</sup> The progression of diabetic retinopathy can have a deleterious effect on patients, both physically and emotionally. Advanced diabetic eye disease can have a significant economic burden on the patient, family members, society, and the health care system.<sup>6</sup>

According to the recommendations of the American Academy of Ophthalmology, the first fundus examination in patients with type I diabetes mellitus should be performed 5 years after diagnosis because retinopathy rarely develops before this period. However, patients with type II diabetes mellitus should be examined immediately when they are diagnosed, because the duration of diabetes is uncertain and some degree of diabetic retinopathy may be present.<sup>7-9</sup>

Several multicenter studies have shown that if laser photocoagulation is initiated at the proper time for treatment of diabetic retinopathy, the probability of blindness is considerably reduced. Hence proper management of diabetic eye disease requires collaboration between an internist and an ophthalmologist.<sup>10-13</sup> Furthermore, patient education regarding diabetes and diabetic eye disease is essential for compliance with treatment.

The primary objective of this study is to highlight socio-demographic factors responsible for blindness caused by diabetic retinopathy among the Egyptian population.

## Materials and methods

This study was conducted among a sequential sample of 397 diabetic patients with preventable or treatable retinal complications. The study included patients presented to governmental hospitals of Kasr El ini (Cairo University Hospital), Beni-Suef University Hospital, insurance clinics, Agoosa and Mabarra Ministry of Health hospitals, and private clinics where the authors work. These patients represented samples from almost all health sectors in Egypt: national health insurance, ministry of health, university teaching hospitals, and the private sector. The study was conducted between February 2008 and March 2010.

Inclusion criteria included patients with diabetic vitreous hemorrhage, tractional retinal detachment involving or threatening the macula, rubeosis irides, macular edema with foveal hard exudates, and cystoid or ischemic maculopathy. Exclusion criteria included all diabetic patients without the abovementioned complications and patients with peripheral stationary tractional retinal detachment.

**Table 1** The questionnaire

1. Hospital or clinic
2. Age
3. Gender
4. Residence: urban, rural, or suburban
5. Educational level
6. Onset of diabetes
7. Treatment: tablets or insulin
8. Controlled or not, and duration of control
9. Family history of diabetes
10. Consanguinity
11. Associated conditions:
a. Systemic:
i. Hypertension
ii. Renal
iii. Smoking even if passive or ex-smoker
iv. Heart
v. Neuropathy? Foot or hand tingling and numbness
vi. Cerebral infarction
b. Ocular:
i. Glaucoma
ii. Cataract
12. Do you follow up with a physician?
13. Prior to visual impairment, did your physician tell you about periodic ocular check up?
14. Why did you consult an ophthalmologist? Regular follow up or when vision dropped
15. Before you met ophthalmologist, did you know that diabetes could lead to blindness?
16. Source of information about diabetic eye disease? Internist, ophthalmologist, patients, media, or readings
17. History of laser treatment?
18. Costs of treating diabetic retinopathy
19. Impact of eye condition on the patient functioning and career
20. Ocular condition: diabetic vitreous hemorrhage, tractional retinal detachment involving or threatening the macula, rubeosis irides, macular edema with foveal hard exudates, cystoid or ischemic maculopathy

During examination of diabetic patients, those who are legally blind secondary to advanced diabetic retinopathy were asked to answer a questionnaire (Table 1). The data included age, sex, residence, educational level, duration of diabetes, duration of diabetes adjustment, type of therapy, family history of diabetes, consanguinity, smoking, associated systemic disease (eg, hypertension, nephropathy, neuropathy, cerebrovascular, myocardial infarction), associated cataract, and glaucoma. Several questions were used to assess the patient education regarding diabetic eye disease and its impact on their occupational status, laser treatment, and cost of treatment of diabetic retinopathy.

## Data analysis

Data were statistically described in terms of mean  $\pm$  standard deviation (SD), frequencies (number of cases) and relative

frequencies (percentages) when appropriate. Multivariate logistic regression analysis was done to test for the preferential effect of the independent variables of age, sex, residence, education, source of information about diabetic retinopathy, and the awareness of patients about the sight-threatening effect of diabetes mellitus. A probability value (*P*-value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2003 (Microsoft Corporation, NY) and SPSS (SPSS Inc, Chicago, IL).

## Results

The data were collected from these patients. As shown in Table 2, the mean age was 56 years (SD  $\pm$  8.56). The number of males was 155 (39%) and females was 242 (61%). A total of 123 (31%) reported they smoke, whereas 274 (69%) did not.

There were 196 patients (49.4%) living in urban areas, 144 (36.3%) in rural and 57 (14.4%) living in suburban areas. The mean duration of diabetes mellitus was 16.1 years (SD 6.78). Family history of diabetes mellitus was positive among 320 (80.6%), whereas 77 patients (19.4%) had no family history of diabetes mellitus. Consanguinity was positive among 98 patients (24.7%).

**Table 2** Sociodemographic and clinical data

Sociodemographic data	Mean $\pm$ SD	Patient number (%)
Age, years	56 (8.56)	
Sex		
Male	155 (39%)	
Female	242 (61%)	
Residence		
Urban		196 (49.4%)
Rural		144 (36.3%)
Suburban		57 (14.4%)
Duration of diabetes mellitus in years	16.1 (6.78)	
Family history of diabetes mellitus		320 (80.6%)
Consanguinity		98 (24.7%)
Associated systemic disease		
Peripheral neuropathy		350 (88.2%)
Hypertension		237 (59.7%)
Cardiovascular disease		64 (16.1%)
Nephropathy		23 (5.8%)
Cerebrovascular disease (stroke)		20 (5%)
Associated ocular disease		
Cataract		164 (41.3%)
POAG		13 (3.3%)
Neovascular glaucoma		10 (2.5%)

**Abbreviations:** POAG, primary open angle glaucoma; SD, standard deviation.

The patients' levels of education were also recorded. Out of the 397 patients, 140 (35.3%) were found illiterate, 59 (14.9%) were able to read and write, 161 (40.6%) had some degree of education ranging from primary to high school diploma, 35 (8.8%) had a graduate university degree, and only 2 (0.5%) had postgraduate studies.

Diabetic peripheral neuropathy was the most common associated systemic disorder, with tingling and parathesia symptoms recorded in 350 (88.2%) patients. Hypertension ranked second, with 237 (59.7%) patients. Cardiovascular disease such as myocardial infarction was noted in 64 (16.1%) patients. Nephropathy was reported among 23 (5.8%) patients, and 20 (5%) patients had a prior cerebrovascular accident.

The most common cause of blindness was diabetic vitreous hemorrhage affecting 359 patients (90.4%). Other causes of blindness were tractional detachment (165 patients, 41.6%), cystoid macular edema or foveal hard exudates (114 patients, 28.7%), end stage diabetic retinopathy (37 patients, 9.32%), and central retinal vein occlusion (16 patients, 4%).

A total of 164 (41.3%) patients had associated cataract. Glaucoma was reported in 23 patients (5.8%): 13 (3.3%) patients were noted to have primary open angle glaucoma, while 10 (2.5%) patients had neovascular glaucoma.

A total of 349 (87.9%) patients reported regular follow up with an internist, whereas 48 (12.1%) did not.

In our structured interview, we assessed patient education, source of information about diabetic retinopathy, and the effectiveness of the doctor–patient relationship.

When questioned about diabetic retinopathy as a cause of blindness, only 158 (39.8%) patients knew that diabetes mellitus can be sight threatening, while 239 (60.2%) were not aware until they developed sight-threatening complications. Only 118 (29.7%) were informed by the internist about the necessity of dilated fundus examination. Forty-two patients (10.6%) reported that they follow up regularly with an ophthalmologist, whereas 355 (89.4%) reported that they have been to ophthalmologist only because of visual deterioration.

Regarding patient education and source of information about diabetic retinopathy, 139 (35%) chose their internist, 391 (98.5%) chose their ophthalmologist, 59 (14.9%) referred to other patients, 34 (8.6%) chose media, while 14 (3.5%) acquired their knowledge on diabetic retinopathy through reading printed articles.

Multivariate logistic regression in Table 3 showed that age, sex, residence, patient knowledge acquired through

**Table 3** The preferential effect of independent variables (age, sex, residence, education, role of internist, ophthalmologist, patient, and media in predicting the awareness of patients about the sight-threatening effect of diabetes mellitus

Independent variable	Odds ratio	95% CI for odds ratio		P-value
		Lower	Upper	
Age	1.013	0.965	1.064	0.603
Sex	2.051	0.790	5.326	0.140
Residence	1.131	0.628	2.038	0.682
Education level	1.473	1.092	1.987	0.011
Internist	156.058	63.318	384.632	0.000
Ophthalmologist	0.573	0.021	15.947	0.743
Patient	8.508	2.988	24.226	0.000
Media	29.962	5.567	161.257	0.000
Reading	0.69	0.001	11.9	0.998

**Abbreviation:** CI, confidence interval.

ophthalmologist, and reading printed articles were found insignificant, while education level (odds ratio [OR] 1.47, confidence interval [CI] 1.092–1.99,  $P = 0.01$ ), internist (OR 156.1, CI 63.31–384.63,  $P < 0.001$ ), contact with other patients (OR 8.51; CI 2.99–24.23;  $P < 0.001$ ), and media (OR 29.96; CI 5.57–161.26;  $P < 0.001$ ) had a significant impact on awareness of patients about diabetic retinopathy.

A total of 130 patients (32.7%) received laser treatment for diabetic retinopathy at the time of the survey.

Regarding the impact of diabetic eye disease on work, 179 (45.1%) took early retirement because of visual loss related to diabetes mellitus.

A total of 291 (73.3%) patients partially paid for their diabetic retinopathy treatment. The cost varied from 20 to 8000 Egyptian pounds with a mean of 630.5 Egyptian pounds. The government supported 314 (79.1%) patients. The cost varied from 300 to 8200 Egyptian pounds with a mean of 2523.41 Egyptian pounds paid by Ministry of Health and National Health Insurance. The total economic burden for treating diabetic eye disease in these patients was 975,840 Egyptian pounds: the government paid 792,350 (81.2%), while patients paid 183,490 (18.8%).

## Discussion

The Wisconsin Epidemiological Study of Diabetic Retinopathy (WESDR) concluded that 3.6% of those diagnosed with type I and 1.6% of those diagnosed with type II diabetes mellitus were legally considered blind. For type I

diabetes mellitus, blindness was mostly (86%) due to diabetic retinopathy. For type II, blindness was related to retinopathy in 33% of the cases.<sup>14</sup>

The annual incidence of retinopathy requiring ophthalmological follow up or treatment has been reported to average 1.5% after 1 year. Between 6% and 9% of patients with proliferative retinopathy or severe nonproliferative disease would become blind each year.<sup>15</sup>

In our study, living in urban areas was not an advantage; as 196 (49.4%) of the patients included in this study developed advanced diabetic eye disease.

Our results show that patient awareness about diabetic retinopathy was low, since only 158 (39.8%) knew about the possible deleterious effect of diabetes on eyesight. This may be related to low patient education, as 140 (35.2%) were illiterate. Illiteracy may contribute to non-compliance and inefficient doctor–patient education. Low income may discourage patients from seeking medical advice.

However, the result for patient awareness in the present study is higher than in other Egyptian and Indian studies which demonstrated that 14.7% and 18% of patients respectively were aware of the hazards of diabetes mellitus for the eyes.<sup>4,16</sup> The difference may be attributed to better distribution of the patient sample through all socioeconomic classes of the Egyptian population and not only the low, illiterate one.

Effective methods to deliver patient education and teach self-management skills that result in longer-term improvements to health are needed. All primary care organizations, as suggested by the Diabetes National Service Framework and the National Institute for Clinical Excellence, must offer structured educational programs to people with diabetes in order to improve glycemic control, reduce requirement for diabetes medication, improve early detection of diabetic complications, and treatment satisfaction.<sup>17–22</sup>

Multivariate logistic regression showed the importance of education in predicting patients' awareness about diabetic retinopathy (Odds ratio, 1.47, CI 1.092–1.99,  $P = 0.01$ ). With regard to the source of information on diabetic retinopathy, our result shows that the sources were multiple and patients' level of knowledge varied. Almost one-third of the patients acquired their knowledge through their internist, while most (391, 98.5%) chose their ophthalmologist after their visual loss. Multivariate logistic regression showed the role of the internist to be of utmost importance in predicting the awareness of patients about

diabetic retinopathy with OR 156.1, CI 63.31–384.63,  $P < 0.001$ . Patients present late to the ophthalmologist, and the role of the internist in the prophylaxis, patient education, and early detection of diabetic retinopathy is crucial.

Although 59 (14.9%) patients referred to other patients and 34 (8.6%) chose media as a source of information about diabetic eye disease, both sources were found to be statistically significant in promoting patients' awareness about the sight-threatening effect of diabetes mellitus (other patients OR 8.5, CI 2.99–24.23,  $P < 0.001$  and media OR 29.96; CI 5.57–161.26,  $P < 0.001$ , respectively).

Laser photocoagulation represents the mainstay of prophylaxis against complications of diabetic retinopathy.<sup>11</sup> In our study, only 32.7% of patients received laser treatment at the time of the survey.

This study showed that the Egyptian government carried most of the direct costs of treating diabetic retinopathy. The government expenditure constituted 81.2%, while the patient's economic burden was only 18.8%. The indirect cost could not be calculated. The main bulk of the indirect cost is lost productivity due to temporary work disability, absenteeism, early retirement, rehabilitation, and medication fee.<sup>22</sup> In this study, 45.1% had early retirement because of visual loss related to diabetes mellitus.

The strength of our study lies in the relatively large sample size of patients and the structured interview, which included much sociodemographic data besides the clinical examination. This descriptive study has included data from several referral centers representing the four main health organizations in Egypt.

The following limitations have to be realized: firstly, the self-reported nature of the questionnaire is subject to informant bias; and secondly, the selection bias, which is due to exclusion of diabetic patients with normal fundus.

In conclusion, this descriptive study found that illiteracy contributes to noncompliance and late presentation. The role of the internist and media in improving the awareness of patients about diabetic retinopathy is of utmost importance.

A continuous medical education program with implementation of evidence-based practices and screening programs for early detection of diabetic retinopathy are essential to improve the standard of care.

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## Disclosure

The authors report no conflicts of interest in this work. The authors alone are responsible for the content and writing of the paper.

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