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Assessment of the awareness of eye complications among diabetic patients attending the outpatient clinics in Jeddah Eye Hospital in Jeddah City, Kingdom of Saudi Arabia, 2015

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Thesis Committee Chair: Usha Ramakrishnan, PhD

An abstract of

A thesis submitted to the Faculty of the

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ABSTRACT

OBJECTIVE: To assess the awareness of diabetes complications, especially diabetic retinopathy among diabetic patients who visit the outpatient clinics in Jeddah Eye Hospital and the role of socio-demographic characteristics, medical risk factors, and screening-related factors.

METHODS: A total of 380 participants were selected from the diabetic patients visiting the outpatient department from June 1 to July 30, 2015. We interviewed patients using a questionnaire that included questions about their diabetic clinical status and socio-demographic characteristics and their awareness of diabetes complications, eye screening and eye care-seeking behavior.

RESULTS: Out of 380 participants, 52.4% were female. The average age was 58.3 years. The majority (89.7%) of patients had type 2 diabetes. We found that 92.4% of the participants were aware of eye complications due to diabetes, but only 10.5% knew how frequently they should have their eyes checked. . Nearly two-thirds of patients reported lack of knowledge about diabetes eye complications as the main reason for not getting an early eye screening. The level of awareness of diabetes-related complications was significantly associated with educational level, source of patient information, place of residency, and frequency of follow up visits.

CONCLUSION: Despite the high level of awareness of the connection between diabetes and eye diseases, a high percentage of patients are not receiving eye check ups at the optimal frequency for preventing complications or within the timeframe recommended by the national guidelines. More efforts are needed to promote appropriate eye care seeking behavior in order to prevent further increases in diabetic eye complications.

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Table of Contents

Chapter 1: Introduction

1.1 Background

Diabetes mellitus is a major health problem all over the world. [1] A chronic disease on the increase worldwide, diabetes is a metabolic condition in which blood glucose levels increase above normal, called hyperglycemia. Hyperglycemia is associated with long-term damage, dysfunction, and organ failure (including the kidneys, eyes, blood vessels, heart, and nerves).

Diabetes mellitus is diagnosed based on certain plasma glucose criteria. The criteria for diagnosis is dependent upon measurements of the fasting plasma glucose (FPG) level (FPG ≥126 mg/dl) or the 2-hour plasma glucose (2-h PG) level after consumption of a carbohydrate-rich drink that contains 75 g of glucose, known as the oral glucose tolerance test (OGTT) (2-h PG ≥200 mg/dl) or the glycosylated hemoglobin (HA1C) criteria (HA1C ≥ 6.5%). These laboratory tests are used for diabetes screening and diagnosis, as well as for detecting pre-diabetes cases. [2]

Pathologically, diabetes is caused by the destruction of beta cells in the pancreas, leading to deficiency of insulin or resistance to insulin. Beta cells secrete insulin; therefore, their destruction or dysfunction results in inadequate secretion that leads to diminished responses by target tissues. Consequently, blood glucose control is altered and blood glucose levels increase as a result. [3]

There are two main types of diabetes, type 1 and type 2. In type 1, known as insulin-dependent diabetes or juvenile-onset diabetes, the body's immune system attacks beta cells and destroys them such that they are incapable of producing insulin. As such, people with

type 1diabetes have to rely on insulin injections. Type 1 diabetes accounts for 5-10% of diabetes cases globally. Type 2, known as non-insulin-dependent diabetes or adult-onset diabetes, is associated with relative insulin deficiency and insulin resistance, which is the inability of the target cells to respond to insulin. Not all of those with type 2 need to use insulin for treatment. There are many different causes type 2 diabetes. The etiology is not fully understood, but the autoimmune destruction of pancreatic cells does not occur in this situation. Diabetes type 2 accounts for 90% to 95% of diabetic cases globally. [4] There is a particular concern of increasing type 2 diabetes among children and adolescents in many regions of the world. Type 2 diabetes outnumbers type 1 diabetes by a ratio of 4:1 in some parts of the Asia-Pacific region. [5]

Diabetes mellitus affects the vasculature of the eyes, which leads to many disorders like recurrent sties, chronic glaucoma, chalazion, vitreous hemorrhage, cataracts, cranial nerve palsies, diabetic retinopathy and blindness. [6] Retinopathy is the commonest disease affecting the eyes of diabetics. It is a chronic and progressive disease that occurs as a result of an alteration in the blood vessels of the retina. It is becoming one of the main causes of blindness in the age group of 20-60 years worldwide. [7]

1.2 Study Rationale

Assessment of the awareness of eye complications among diabetic patients has been done in some hospitals in various countries including Malaysia and Nigeria. Notably, eye complications are one of the most common conditions in diabetics; consequently, assessing awareness among diabetics is a necessary educational measure to help in controlling diabetes. Eye complications due to diabetes, such as retinopathy, exact a social disease

burden and have economic implications; as such, a high level of awareness is needed to educate diabetics about the debilitating complication. [7]

1.3 Study Objectives

Due to the lack of information about the level of awareness about eye complications among diabetics in Jeddah, Saudi Arabia, we chose to conduct a study with the following objectives to help guide ongoing efforts to manage complications in diabetic patients.

- To study the demographic data, medical risk factors, and screening-related factors for diabetic patients who visit the outpatient clinics in Jeddah Eye Hospital; and
- To assess the awareness of diabetes complications, especially diabetic retinopathy, among diabetic patients.

Chapter 2: Literature Review

2.1 Burden of Diabetes Worldwide

The World Health Organization (WHO) estimates there are about 280 million diabetics worldwide. They report that this number will increase to more than 550 million by the year 2025, with more than 30% of cases predicted to be situated in the Asia Pacific region. [7] Diabetes mellitus is one of the most common chronic diseases, increasing significantly in nearly all countries as a result of lifestyles changes and rising rates of obesity. [8] Among adults aged 20-79, the world prevalence of diabetes is estimated to increase to 7.7%, and 439 million adults will be affected by 2030. Between 2010 and 2030, it is estimated that in developed countries there will be a 20% increase in the number of adults with diabetes, while in developing countries, the number of adults with diabetes is expected to increase by 69%. [9]

North America, the Eastern Mediterranean and Middle East (EMME), and South Asia are the regions with the highest prevalence, and their numbers are expected to increase by 50% over the next 20 years. [9] In developed countries, most diabetics are over 64 years old, while in developing countries the majority is between 45-64 years of age. [8] Many factors, such as aging, urbanization and the increased prevalence of chronic disease related factors like obesity and lack of physical activity exacerbate the problem of diabetics. [9]

2.2 Diabetes Mellitus in Saudi Arabia and Middle East

The Arab population in the Middle East and North Africa (MENA) is experiencing a rise in the prevalence of diabetes. The rise is associated with economic developments that have caused lifestyle changes characterized by low physical activity. The reduction of

manual labor has increased the prevalence of physical inactivity and diabetes. In order to determine the impact of physical inactivity on mortality, years of life expectancy is typically estimated. [10]

The MENA region had the highest diabetes prevalence rate in the world in 2012. The International Diabetes Federation estimates that in 2030 around 59.9 million people in the MENA region will be diabetic. [10]

Within the MENA region, there are specific countries with higher diabetes prevalence rates than others; Saudi Arabia is at the top with the highest adult diabetes prevalence, and Egypt has the highest overall number of diabetics. [10] Saudi Arabia also has the highest prevalence of physical inactivity in the region. When life expectancy was examined in different regions of Saudi Arabia, it was found that a reduction of physical inactivity rates in Saudi Arabia would result in a gain of an additional 1.5 years of life expectancy compared to average one year gain of life expectancy for the MENA region. [10]

Saudi Arabia is in the top ten countries with the highest prevalence of diabetes in the world. In 2013, the estimated prevalence of diabetes was 23.9%, [11] while Egypt had a prevalence rate of 7.2%. [10] Even within countries, there are particular regions with higher than average diabetes prevalence rates. In 2014, Basra, Iraq, had a prevalence rate of 19% while the country's average prevalence rate was 7.4%. Prevalence rates vary depending on the socio-economic development of the region. That same year, rural Saudis had a prevalence rate of 19.5% while urban Saudis had a prevalence rate of 25.5%, and a rural population in Egypt had a prevalence rate of 4.9% while the urban population had higher rates: 20% among those in a higher socioeconomic class and 13.5% among those in a lower socioeconomic class. [10]

Notably, the interplay of genetic and environmental factors contributes to the incidence of diabetes. Arabs are genetically predisposed to the disease; this has been shown in clinical studies that compared Arabs and Caucasians and showed that Caucasians had a lower prevalence rate compared to Arabs. [10] The reason why such predispositions exist is linked to the practice of consanguineous marriage, which is common in Arab culture. A study investigated the mechanism of consanguinity on diabetes etiology among Saudi people by genotyping single-nucleotide polymorphism (SNP); the results showed that consanguinity is a risk factor for diabetes. [10] The prevalence of consanguinity in Saudi Arabia is 60%; the situation explains why the prevalence rate for diabetes is high in the country. [10] Diabetic patients require a minimum of 2-3 times more health care resources than those who do not have the disease, thereby presenting an economic burden. Due to the economic inequality among the MENA regions, health care expenditures vary. Healthcare expenditure for diabetes mellitus in Saudi Arabia has reached $682 per person, which is approximately 21% of the overall amount. [10]

2.3 Diabetic retinopathy (DR)

Worldwide, it is estimated that 15,000 to 39,000 patients will lose their vision as a result of diabetes. [7] Of diabetes age 40 and above, 14% will develop diabetic retinopathy (DR) after 5 years of diabetes. [7] Around 60% of those with type 2 diabetes and 90% of those with type 1 diabetes had DR after 20 years of having diabetes. [11] The United Kingdom Prospective Diabetes Study (UKPDS) and the Diabetes Control and Complications Trail (DCCT) confirmed the association between the development and progression of DR and presence of chronic hyperglycemia. Due to hyperglycemia, the retina is exposed to a state of microvascular instability. In DR, the microvascular changes start in the small

capillaries before involving the large vessels. These changes lead to the thickening of the capillaries' basement membrane, depletion of the smooth muscle cells, loss of the vascular endothelial cells, occlusion and recanalization of the vessels and finally, neovascularization. [11]

DR is generally classified into proliferative diabetic retinopathy (PDR) and nonproliferative diabetic retinopathy (NPDR). PDR injuries are characterized by the presence of new vessels on the optic disk and retina, hemorrhages, and fibrous tissue proliferation. NPDR injuries include intraretinal microvascular abnormalities, cotton wool spots, hemorrhages, and many others lesions. PDR affects 50% of type 1 diabetic patients, 30% of insulin-dependent type 2 diabetic patients and 5-10% of non-insulin dependent type 2 diabetic patients after 15-20 years of diabetic. Based on severity level, DR is classified as DR absent, mild NPDR, moderate NPDR, severe NPDR, very severe NPDR, early PDR, and high-risk PDR. [11]

Although there is no cure for DR, there are different modalities that may help in preventing, delaying, or reducing vision loss. Strict blood pressure and blood sugar control has been shown to be effective in preventing and stopping the progress of retinopathy. Laser photocoagulation, intraocular injection and surgery are the available treatment modalities. [11]

Screening for diabetic retinopathy through a retinal examination is considered to be a valid and relatively simple technique. [12] People with either type 1 or 2 diabetes should get an annual retinal examination at minimum; patients with advanced conditions require more frequent examinations. [11] Obstacles such as limitations in public health approaches for DR (compared to other visual disabilities) and the limited number of skilled staff,

specifically in primary care settings, must be overcome in the Eastern Mediterranean Region in order to implement a successful screening program. [12]

2.4 Diabetic Retinopathy Awareness

A study on the awareness of eye complications among diabetics in Australia found that only 37% were aware of the link between their condition and eye complications. A similar study conducted in the United States found that 65% of diabetics were aware of the link between diabetes and eye complications. In India, an assessment of awareness among diabetics in urban settings found that only 27% were aware of the association between diabetes and eye complications. [7] These figures point to the fact that awareness of the association between eye complications and diabetes is low. The education affects the level of awareness necessary for controlling diabetes and reducing its progression to the debilitating complication. Furthermore, low levels of awareness may reduce the chances of seeking timely eye care and thereby, possibly increasing the burden of visual impairment. [14]

An observational study conducted in Malaysia in peripheral clinics in the Melaka area to measure the awareness of diabetic complication among diabetics showed that 79.8% of diabetics were aware of the common complications of diabetes, and 83% were aware of DR. Awareness was found to be significantly associated with educational status and duration of the disease. The patients who had diabetes for 5 years or more and those with a high education level (secondary and graduate or above,) were more aware of the effects of diabetes (p-value 0.017, 0.037 respectively). Multiple logistic regression showed a significant association between the duration of 6 months or less since last ophthalmological evaluation and the presence of DR (p-value 0.017). Also, the presence of

DR was significantly associated with a duration of diabetes of more than 11 years (p-value <0.001). [13]

Another Malaysian study aimed to assess awareness of diabetes complications, especially DR, among type 2 diabetes patients during their first visit to the eye clinic of University of Malaysia Medical Center (UMMC) in Kuala Lumpur. The study showed that 86% of the patients were aware of the effects of diabetes on the eyes. The awareness level was found to be associated with educational status. Patients with higher educational status had a higher level of awareness of eye complications due to diabetes. It was found that the awareness of eye complications was also associated with the choice of healthcare professionals: 60% of the patients who did not know about DR complications had no idea whom to communicate with, while 81.4% of those who were aware of DR chose to visit an ophthalmologist. There were however no significant differences in the level of awareness by gender, race, control of blood sugar, as well as presence of DR. [7]

A population-based study was done to measure the knowledge of diabetes and DR among the population in five southern rural districts of Tamil Nadu, India. In this study, 1,938 rural populations were randomly selected out of 28,347 individuals for interviews. Participants were over 15 years old (mean age, 29±13 years; range, 15-77). Women represented 60% of the population. Of these, 49% had knowledge about DM and 37.1% were aware of DR. More women had knowledge of diabetes compared to men (p-value 0.0423). [15]

A population-based survey was conducted to assess awareness of diabetes and DR among the Singaporean Malay population. In this study, there were 3,280 participants from 40-80 years old (and a 78% response rate). Out of these, 768 diabetics were included. The

inclusion criteria were random blood glucose level ≥ 11.1 mmol/l, having been previously diagnosed as diabetic by a physician, or the use of diabetic medications. Participants were interviewed to assess their awareness, and their HA1C and blood pressure were measured. Retinal photography was assessed for all patients. Of these 768 diabetic participants, 101 (13.2%) were diagnosed during the study. Of these 101 participants, 6 (5.9%) were unaware of their diagnosis despite their taking diabetic medications. It has been found that those unaware of their diabetes had higher HA1C (9.7%, P<0.001). In all, 272 (35.4%) were found to have DR, and 227 (83.4%) were unaware they had DR. Patients who were unaware of their DR had significantly higher HA1C compared to those who were. The older patients (aged 70-80) were also less likely to be aware of their retinopathy conditions compared to some younger patients (aged 40-49). [16]

A study was conducted in Baltimore, Maryland, among Hispanics with and without diabetes to assess their knowledge of eye disease. The questionnaire contained 3 main sections: basic demographic data, information about health-seeking behaviors, and knowledge about diabetes and DR. The study subjects (204 diabetics and 349 non-diabetics) were classified into four groups: individuals without either diabetes mellitus or family history of diabetes, non-diabetics with a diabetic family history, those who were newly-diagnosed DM, and those diagnosed with diabetes more than one year before the study began. In all, 18% of those without either DM or a diabetic family history had knowledge about eye diseases, compared to 29% for those without DM but with diabetic family history, 36% of those who were newly diagnosed diabetics, and 52% of those diagnosed with diabetes over a year before the study began. Beyond that, 16% of those without either DM or a diabetic family history knew that tight control of diabetes could

prevent eye complications, as did 28% of those without DM but with diabetic family history, 13% of those who were newly diagnosed diabetics, and 34% diagnosed with diabetes over a year before the study began. It was also reported that 33% of those without either DM or a diabetic family history knew about the importance of getting a dilated eye exam, as did 51% of those without DM but with diabetic family history, 31% of those who were newly diagnosed diabetics, and 48% diagnosed with diabetes over a year before the study began. Only 30% of newly diagnosed diabetics visited an ophthalmologist regularly. Many had never had a dilated eye examination: this was true for almost half of those who had diabetes for more than a year and 79% of those who were newly diagnosed. The main sources of information about diabetes and DR were clinics, family, and friends. Only a small proportion of the participants stated that written material or the Internet was their source of information (5% of those without diabetes said so, and 2% of those with diabetes) [17]

A cross-sectional study was conducted to determine awareness about diabetic ocular complications among diabetics in Western Nigeria. A sample of 148 patients was randomly selected from the medical outpatient department in one of the tertiary hospitals. Patients were interviewed using a semi-structured questionnaire. The information obtained included demographic data and DR health seeking behavior. The majority of patients (83%) were aware of the effects of diabetes on different body parts, 77% were aware of the effects on eyes, 54% were aware of kidney complications, 41% were aware of central nerves system complications and 39% were aware of the effect on blood vessels. About a third of the patients (33.1%) did not recognize the importance of a routine eye examination for diabetics, 26.4% stated that there is no need for an eye examination, and 16.2% said that it should be done once. Patients who had had diabetes for more than 10

years had a greater awareness of the effects of DM on the eyes than those who had had diabetes less than 5 years. Awareness of diabetes complications was found to be higher in patients with more education than those with less. [6]

A study conducted by Harris aimed to examine the relation between blood glucose level (measured as HA1C) and the frequency of self-monitoring blood glucose (SMBG) in type 2 diabetes. The questionnaire, laboratory, and clinical data were obtained from the third National Health and Nutrition Examination Survey (NHANES III). Included in the study were 1,480 patients who had type 2 diabetes. They were asked about diabetic medication and blood glucose self-monitoring. HA1C measurements were made for 88% of participants in the study during clinical examinations. Of the participants who had either never checked their blood glucose level or checked it less than once per month, 29% were on insulin therapy, 65% took oral hypoglycemic medications, and 80% were using diet alone for diabetes control. Of the participants who self-monitored at least once per day, 39% were on insulin and 5-6% took oral hypoglycemic medication or used diet alone. There was little association between HA1C and proportion of patients monitoring their glucose level at least once per day or once per week. [18]

A retrospective cross-sectional study was conducted at the University Hospital in Basel, Switzerland, in 2006 to assess the association between the number of SMBS per day and HA1C in Type 1 diabetes. HA1C was done 3-4 times a year during clinic visits on 150 study participants. The average number of SMBG per day was calculated during the month prior to HA1C level measurement. A total of 468 HA1C values and preceding SMBG data from the participants were used for analysis. Multivariable analysis was conducted after adjustment for gender and psychological problems was made. It was found that with each

additional SMBG measurement, HA1C differed by -0.19% for <4 SMBG measurement per day and -0.02% for >4 SMBG per day. [19]

A population-based cross-sectional study was conducted in Cape Town to assess DR awareness among diabetics as a part of the Rapid Assessment of Avoidable Blindness (RAAB) survey initiated in 2010. The survey included 1,784 participants and 305 known cases of diabetes. Of the diabetics, 126 (40%) were using diabetic medication, 54 (17%) were maintaining glycemic control, 90 (29%) didn't know any diabetes risk factors, 136 (48%) were aware of the need for annual retinal examinations, and 226 (80%) were aware of DR. DR awareness was significantly higher among type 1 diabetic patients (97%) than type 2 (75%). A higher level of DR awareness was found to be correlated with a better educational level. [20]

Chapter 3: Data & Methods

3.1 Study setting

The study was conducted in Jeddah city. Jeddah is one of the largest urban cities in Saudi Arabia. It is located in the western region on the Red Sea coast. As of 2012, the population in Jeddah was around 4.3 million. Jeddah is considered the commercial capital of Saudi Arabia. It is also the main gateway to Muslim holy places.

There are around 35 hospitals and medical facilities in Jeddah, and this number is consistently growing; more hospitals are expected in the coming years. All healthcare facilities in the city are either public or private and are supervised by the Ministry of Health. [21]

There are many private eye hospitals and clinics in Jeddah, but Jeddah Eye Hospital is the only governmental and specialized hospital for eye problems that serves patients from Jeddah and the towns around it (Figure 1) Jeddah Eye Hospital was established in 1950 as the first specialized hospital for ophthalmology and surgery. The hospital consists of several medical and surgical departments as well as support services. There are 36 specialized, diagnostic and public clinics covering all different ophthalmology specialties, such as vitreoretinal, pediatric ophthalmology, neuro-ophthalmology, glaucoma and oculoplasty. There are eight major operation rooms in the operation theater. Operations in the department are focused on cataract, glaucoma, oculoplasty, squint and vitroretinal surgeries. The hospital provides health care and support services to the patients according to Ministry of Health policies. [22] This study was conducted in outpatient clinic departments in Jeddah Eye Hospital.

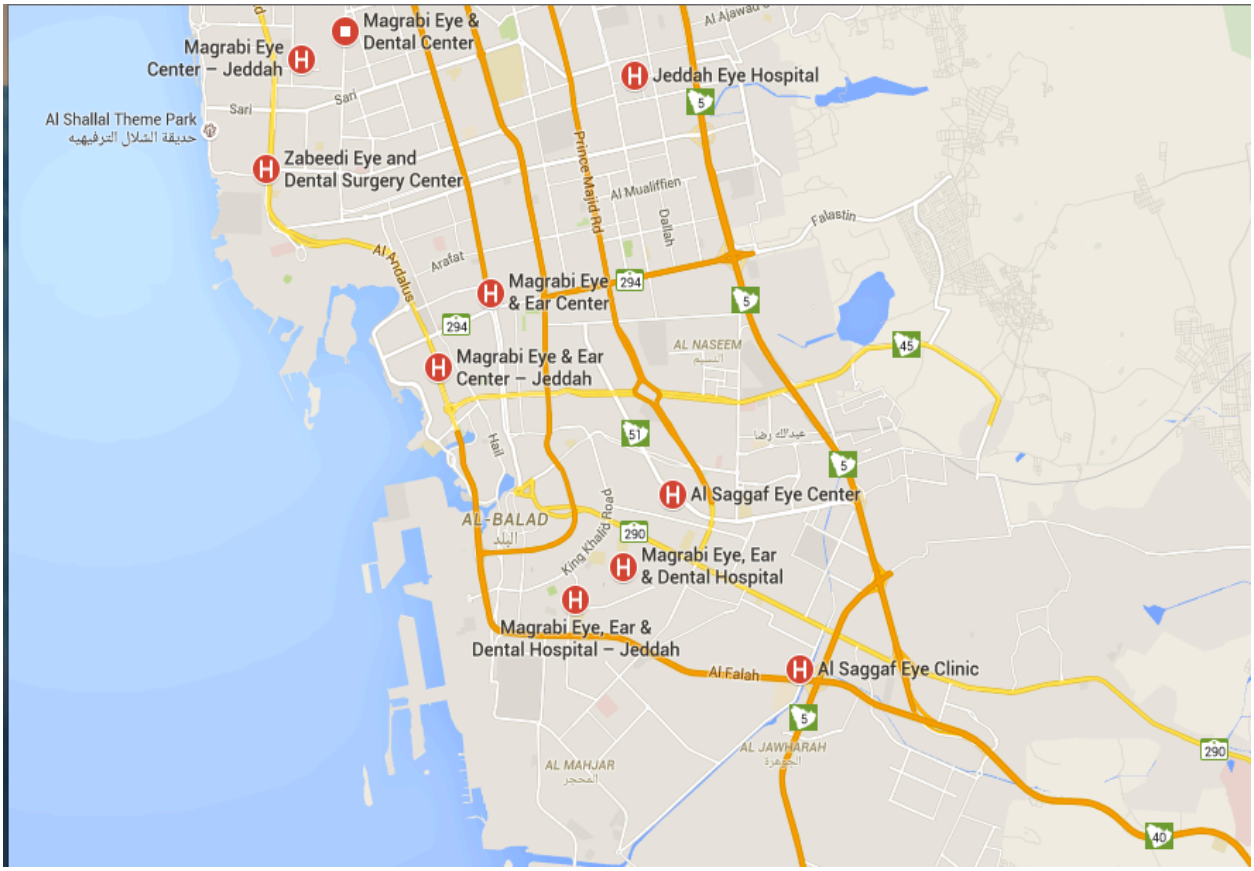

Figure 1: Jeddah Eye Hospital and other main private eye centers and hospitals in Jeddah city. [29]

3.2 Data collection

The sample size was calculated using Jeddah Eye Hospital statistics from 2014, which consisted of data on the 85,000-95,000 patients visiting the outpatient department that year; diabetics represented approximately 35-40% of the total visitors.

We used OpenEpi (www.openepi.com) to calculate the sample size for a 95% confidence level and a margin of error of 0.05. The calculated sample was 380 diabetic patients from the outpatient department. The diabetic population visiting the outpatient department came either with a referral from a primary health care center or had an

appointment in the department. Participants were chosen from three patient waiting areas and selected from the daily clinic lists. The selection process began by finding and selecting the first diabetic patient on each daily clinic patient list. After that, every third patient was selected. If patients did not show up for their appointment, then we would select the next diabetic patient on the list.

Data were collected using a 26 item closed-ended questionnaire, which was administered to 380 randomly selected diabetic patients. Participants visited the outpatient department at Jeddah Eye Hospital from June 1 to July 30, 2015.

The preparation of the questionnaire was done after a detailed literature review; the sources of questions were the Behavioral Risk Factor Surveillance System Questionnaire (2012 and 2014) [27,28] and Tajunisah, et al. (2011). Initially, the information assessed in the questionnaire was demographic data, educational level, and primary healthcare follow up. Multiple questions identified the diabetes clinical status of the patients, such as type of diabetes, duration of diabetes, use of insulin and time between diagnoses and referral for eye screening. Another group of questions was used to assess the awareness of diabetes complications, eye screening and eye care-seeking behavior. In order to apply the questionnaire in the hospital setting, the main steps of the linguistic validation process were taken. This process aimed to obtain a translation in the target language that corresponds conceptually to the original. [23] The questionnaire was translated into the Arabic language by the researcher and another ophthalmologist independently. Two other healthcare workers did the backward translation independently and a comparison of the original and backward translation was made.

Before the start of the study, a pretest of the questionnaire was conducted in a

sample group of five diabetics, following which the necessary modifications were made to enhance its comprehension. A group of three healthcare workers conducted interviews along with the researcher after they had been trained. The healthcare workers and the researcher administered the interviews in Arabic. The responses were recorded manually on paper versions of the form and kept in the researcher's possession until the end of the day. The questionnaires were conducted after obtaining informed written consent from the selected patients.

3.3 Data Entry, Cleaning and Analysis

The paper records were transferred by the researcher into an electronic format with the electronic forms functionality in Adobe Acrobat X Pro (San Jose, CA, 2015) and subsequently exported as an XML file that was analyzed using SAS 9.4 (Cary, NC, 2015). The paper forms were then compared to the electronic forms by dividing the paper forms into 3 groups. For the first group, 20% of the paper forms were randomly selected. The selected paper forms were compared to the data entry of the electronic form. In the second group, every third paper form was compared to the electronic form by an independent advisor. For the third group, every fourth paper form was compared to the electronic form. Any discrepancy between the values in two corresponding fields in each form type was considered an error. For each error, the original paper form was inspected, and the correct entry was identified.

Age was defined as a categorical variable to reflect the age distribution of the study sample. The categories are 0-45, 45-55, 55-65, and 65 and above. Similarly, education had five categories and we combined "master", "diploma," and " university degree" into one group titled "university and higher degree."

We modified the "follow up frequency in the last 12 month" category from "number of times", "don't know", "refused" to "less than four visits in the last 12 months" and "four visits or greater in the last 12 months" in order to reflect the minimal visits recommended by the National Reference of Clinical Guidelines for care of diabetic patients in primary health care. [24]

Blood sugar check up frequency categories were reclassified to "never", "less than 4 times a day", "greater than 4 times a day", "less than 4 times a month", "greater than 4 times a month" and "rarely" to reflect the ADA recommendation for check up frequencies.

Both Years Index (YEARSSINCEDX_CAT) and ADA Referral (REFERRAL_ADA) were created by using the time between diagnosis and referral to reflect the ADA recommendation for eye screening for diabetics.

Years index was classified into "Between 0 and 10 years since diagnosis," "Between 10 and 20 years since diagnosis," or "More than 20 years since diagnosis." ADA referral was divided into "Type 1 Diabetes and More than 5 Years for Eye Screening Referral," "Type 2 Diabetes and More than 1 Year for Eye Screening Referral," "Type 1 Diabetes and Less than or Equal to 5 Years for Eye Screening Referral," or "Type 2 Diabetes and Less than or Equal to 1 Year for Eye Screening Referral."

We modified the "Last time of eye examination" category to better reflect the national reference of clinical guidelines for care of diabetic patients in primary health care, based on ADA recommendations. Eye examination time was divided into "never," "more than one year," "within the past year," or "don't know".

HA1C_ADA was created to show the HA1C level according to the ADA recommended level for the control of diabetes. HA1C_ADA categories were "HbA1c greater than 6.5%" or

"HbA1c less than or equal to 6.5%."

In order to use the outcome of the study effectively, we created a composite variable that measured awareness about eye complications and other chronic diabetes complications among diabetic patients by combining the responses to Questions 19, 22, and 23. First, a summary variable was created by giving one point for each right answer, for each statement in question 19, as well as for those in questions 22 and 23, which was then converted to a categorical variable with three levels, "High," "Med," and "Low" that were based on tertiles on the summary variable.

3.4 Statistical Analysis

An exploratory analysis of the data was done and summary statistics for all independent variables were derived. Continuous variables were summarized with descriptive statistics (N, mean, standard deviation). Categorical variables were summarized with frequency counts and percentages within each category or between levels of a category as appropriate.

Univariate methods were utilized as follows: the Chi-Square tests for association of the dependent variable with each independent variable and associations between all the independent variables with each other, and a t-test or ANOVA to test the association between continuous variables. Bivariate associations were examined between the outcome variable and independent variables of interest, one at a time, followed by a multivariate model using multiple logistic regression analyses. Factors of interest that were significantly associated with the outcome at the bivariate level were included in the multivariate analysis to develop explanatory models using logistic regression analysis.

Confounding was assessed throughout the model-building procedure by examining

the change in the coefficient or effect estimate and the standard error after adding the independent variable to the model. Variables that appreciably changed the estimate were considered to be confounders. Interactions of independent variables were explored via both stratified analysis and multiple logistic regression analysis. Odds ratios and 95% confidence intervals were computed using logistic regression analysis. The final models included all independent variables that remained.

3.5 Ethical consideration:

This study was submitted for Emory IRB review and was classified as public health practice and therefore not subject to review as "human subjects research." This study was approved by the local IRB of the Ministry of Health in Jeddah, Saudi Arabia.

Chapter 4: Results

4.1 Descriptive data

Diabetic participants in this study were aged between 11 and 84 years old; the average age of participants was 58.3 years (STD 10.9). The age in the study sample was normally distributed. Out of 380 participants, 181 (47.63%) were female, 199 (52.37%) were male, and 48 were non-Saudis. Most of the participants (291) resided in Jeddah, while 89 resided elsewhere. In terms of follow up in primary health care centers, 67.1% of the participants had a follow up in primary health care centers while 32.9% of them had never follow up in any primary health care center. A large proportion of participants were illiterate (44.2%), and only 12.4% had a university or higher degree. (Table 1)

4.2 Clinical data

The majority of participants (89.7%) had type 2 diabetes, while 6.1% of participants had type 1 diabetes. A small percentage (4.21%) of the participants did not know the type of diabetes they were suffering from.

More than half of the participants were not using insulin injections (58.1%, 219 participants), while 41.9% (158 participants) were using insulin as part of their treatment regimen.

Most of the participants (91.8%) had visited a doctor, nurse, or other healthcare professional for diabetes in the last 12 months; only 8.2% had not seen a health professional for diabetes in the year before the study was conducted. Of patients who had seen a doctor, nurse, or other health care professional within the last 12 months, 37.4%

(138 participants) had fewer than four, and 62.6% (231 participants) had four visits or more.

Around one third of participants checked their blood glucose level fewer than four times a day (32.9%, 123 participants), which is the ADA recommendation for self check up frequency for type 1 or type 2 diabetic patients on insulin treatment. [2] Only 2.1% (8 participants) checked their blood glucose level more than four times a day. We found that 17.4% (65 participants) checked their blood glucose level fewer than four times a month, while 31.4% (117 participants) checked there blood glucose level more than four times a month. A full 14.7% (55 participants) had never checked their blood glucose level, and 1.3% (5 participants) rarely did.

Out of the participants, 67.1% were referred for eye screening and 32.9% were not. The amount of time it took for participants to be referred for an eye screening ranged from a month to 30 years. Out of the participants, 41.0% had their first eye examination within 10 years of being diagnosed with diabetes. More than one-third of the participants (33.1%) had their first eye examination from 10 to 20 years after diagnosis, while 25.9% had it after more than 20 years of being diagnosed. Only 41.9% of referred participants were referred according to ADA recommendations, which specify referral for an eye screening within 5 years of diagnosis with type 1 diabetes and at the time of diagnosis with type 2 diabetes. [2]

In terms of vision, 63.0% of all participants wore eyeglasses or contact lenses and 37.0% did not. Most participants (82.1%) had had an eye examination in which their pupils were dilated within the past year. Only 7.1% had their last eye check up with dilation more than one year before they were interviewed for this study; 3.2% of the

participants did not know or were not sure whether they had such experience; and 7.6% had never had such an eye examination before.

In terms of retinopathy, more than half of all participants (66.9%) had been told by a doctor that they had retinopathy or been informed by a doctor that diabetes had affected their eyes, and 29.4% of participants had never been told that they had retinopathy or that their diabetic condition could affect their eyes. A small proportion (3.7%) were not sure if they had been told by a doctor about their eye condition.

At the time of the study, 133 participants had their HA1C level tests done, while 247 had not. HA1C levels were >6.5% in 96.2% of the patients who had the test, and <6.5% (the ADA level of control) in 3.8% of them. Clinical variables had different frequencies by gender. (Table 2)

4.3 Awareness of diabetes complication / DR

Participants' knowledge about complications that could arise if diabetes was poorly controlled varied by the particular complication: 64.7% of participants were aware that poorly controlled diabetes could lead to coronary artery disease, whereas the majority of participants (92.4%) were aware of the effects of diabetes on the eyes. These results are shown in (Table 3).

Notably, 81.7% of participants noted that diabetics should have eye checkups even when their blood sugar level is well controlled compared to 13.8% who answered that it was not necessary for diabetics to have eye checkups when their blood sugar level is under control.

Out of all 380 participants, 69.5% (264) answered that diabetics should go for an eye check up every six months and 19.2% (73) responded that the frequency of going for eye

check ups should only be based on when vision is affected. A lower proportion (10.5% or 40) thought that diabetics should seek eye checks up on a yearly basis. Only 0.8% (3) answered that diabetics should go for eye check up every two years.

The level of awareness about (1) complications that could arise if diabetes is poorly controlled, (2) the importance of eye check ups even if blood sugar is under control, and (3) frequency of recommended eye check ups was defined by tertiles that represented low, medium, and high awareness levels. Most of the participants (254 or 67.2%) were aware of the complications after being told by healthcare professionals such as doctors, nurses, ophthalmologists, or optometrists. The media, which included radio, television, and the internet, was the next most common information source for participants (68 or 18.0%). Finally, 56 participants (14.8%) specified family members, friends or relatives with diabetes as their source of information about complications.

In terms of blood sugar control, 200 participants (52.6%) thought that their blood sugar control was not good. Under half (47.4%) thought that their blood sugar control was good.

Participants gave various answers on the available treatment for diabetic retinopathy. The largest proportion of participants (137 or 36.0%) reported that the available treatment for diabetic retinopathy was good control of the diabetes itself; 114 or 30.0% reported laser treatments; and 43 or 11.3% reported surgery. A significant minority (86 participants or 22.6%) did not know that there was treatment for diabetic retinopathy.

Out of the participants, 251 diabetics (66.8%) sought their first eye screening due to a doctor's referral, and 125 participants (33.2%) did so for self-awareness. Notably, 238 of all respondents (62.8%) mentioned lack of knowledge about diabetic eye disease as the

biggest barrier for not getting an eye screening earlier. In terms of major barriers, 59 participants (15.6%) mentioned time limitations, 36 (9.5%) lack of access to eye care, 35 (9.2%) fear of discovering something bad, and 11 (2.9%) cost or insurance issues.

The awareness level was found to be significantly associated with the patients' educational level (p-value=0.002). Patients with a university degree or higher had more awareness compared to those who were illiterate (p-value=0.006). (Figure 3)

The awareness level was also found to be significantly associated with the source of patients' information (p-value <0.0001). Interestingly, those who gained their knowledge from television, radio, newspaper, or the Internet had a higher level of awareness compared to patients who gained their knowledge from healthcare professionals such as doctors, nurses, ophthalmologists or optometrists (p-value=0.01). (Figure 4)

There is a significant association between the place of residency and the level of awareness ($p<0.05$). The participants from Jeddah had a higher level of awareness compared to participants from outside Jeddah.

The frequency of follow up visits to healthcare professionals within the previous 12 months was also significantly associated with the level of awareness (p-value=0.035). The patients who had 4 or more visits in the past 12 months had a higher level of awareness compared to patients who had fewer than 4 visits in the past 12 months (p-value=0.017).

Use of insulin (p-value=0.046) and blood glucose check ups (p-value=0.041) were also significantly associated with awareness level, but no association was shown in logistic regression analysis.

There were no significant associations between level of awareness and age (p=0.22), gender (p=0.50), nationality (p=0.92), type of diabetes (p=0.85), HA1C level (p=0.84), or the presence of DR (p=0.089). (Figure 5)

Chapter 5: Discussion

The prevalence of DR in Saudi Arabia is between 33 and 36% in different regions of the kingdom. [25] The latest national rate of diabetes in Saudi Arabia was estimated to be 27.6% in women and 34.1% in men in 2011, [1] and a study published this year showed that the prevalence of pre-diabetes among the adult population of Jeddah was 9.0% (8.6% in women and 9.4% in men). [26] The high diabetes prevalence rate may suggest a higher DR prevalence than is reflected above. The high pre-diabetes prevalence rate may mean the existence of more diabetes cases than official data shows, and along with that, higher rates of complications like DR.

According to this study, 66.9% of the study population had already been told that they had DR; this finding is indicative of the high prevalence rate of the disease among diabetics.

Increasing the level of awareness is one of the initial steps in any successful program directed to reduce DR. [14]

In our study, 92% of the participants were aware of the effect of diabetes on the eyes, which is higher than other studies. The study conducted in Malaysia by Tajunishah, et al. reported that 86.1% of the participants were aware of the effect of diabetes on the eyes. [7] In another hospital-based study conducted in India, 51% of diabetics were aware of DR as a complication for diabetes mellitus. [15] Since our study was conducted in a specialized

eye hospital, the majority of patients had been referred by physicians for an eye check up. Thus, the patients most probably had been informed about their own diabetes eye complications. [7] This could explain the slightly higher level of awareness in our study compared to other studies.

Regarding the factors contributing to awareness level, patients who had achieved a higher educational level had a higher level of awareness. This significant association supports the concept that education is the cornerstone in creating awareness. [7] Similar findings were reported in the study conducted in Malaysia by Addoor, et al. Awareness was found to be significantly associated with educational status. Patients with a high education level (secondary and graduate or above) were more aware of the effects of diabetes. [13]

Similarly, another awareness study done in Kuala Lumpur, Malaysia, found that the level of awareness was also associated with education status. As their level of education rose, patients had a higher level of awareness of eye complications due to diabetes. [7]

Also, as in our study, a study conducted in Cape Town showed that a higher level of DR awareness was correlated with a better educational level. One of the possible reasons for this is that patients with more education are better able to recognize information and explanations about their health given to them by healthcare professionals, and they have broader access to both audio-visual and written information. [20] In a study conducted among Hispanic individuals with diabetes in Baltimore, it was found that individuals with an educational degree beyond high school were more likely to have more knowledge of diabetes eye complications. [17] A study conducted in a tertiary hospital in western Nigeria showed a similar result. Level of awareness was higher in patients with tertiary education compared to others. [6]

In our study, most participants (67.2%) received information about diabetes and DR complications from physicians, nurses and other healthcare professionals, and 18% of them received their information from mass media such as newspapers, radio, television and the Internet. Similarly, in a study by Munoz, the majority of Hispanic diabetic patients (60%) sought their health information from healthcare workers in clinics and community health centers. [17] A study conducted in Malaysia showed that 52.6% gained their information through healthcare workers while 21.9% did so through mass media. [7]

Though the findings in our study show that a relatively small proportion of patients gained their information about diabetes from the mass media or the Internet, these patients had a higher awareness level than those whose sources were healthcare professionals or friends and family. This raises a question about the effectiveness of the information that is given by healthcare workers to patients, especially the illiterate patients. Illiterate patients represent 44.2% of our study population. This indicates the importance of improving educational techniques by providing more opportunities for healthcare workers to train and improve their skills. The mass media demonstrated its effectiveness as a source of information; spreading simple and direct information about diabetes and its complications through screens or posters in waiting areas may help in changing health-seeking behaviors.

The association between follow-up with healthcare professionals (based on recommended guidelines) and level of awareness was significant in this study but different from the results a Malaysian study. In that study, there was no statistically significant effect of previous follow-up visits for diabetes on level of awareness. [13]

In our study, we found no association between gender and level of awareness. This result is consistent with previous studies about the association between eye complications and gender. A study conducted in Melaka, Malaysia showed that gender did not significantly affect the level of awareness. [13] A Kuala Lumpur study revealed the same result, that there was no significant association between gender and awareness. [7] Diverse findings were noted from a study conducted in rural districts of Tamil, India. In that study, analysis showed a significantly higher level of knowledge among women compared to men. [15]

Lack of knowledge of diabetic eye complications was found to be the main barrier (among 62.8% of participants) preventing patients from getting eye screenings earlier, according to their self-reports. Other reasons were limitation of time (15.6%), lack of access to ophthalmic healthcare (9.5%), fear of discovering eye health problems (9.2%), and cost and insurance issues (2.9%). In comparison, the Malaysian study reports these barriers: lack of knowledge was still the main barrier according to 68.6% of the patients, followed by lack of access to healthcare (5.1%), time limitations (4.4%), cost and insurance issues (2.9%), which was exactly the same percentage as our study, and fear of discovering eye health problems (0.7%). [7]

Limitations:

This study had some unavoidable limitations. First, there was the limitation of time. This study was conducted from June 1 to July 30, which included the Muslims' month of fasting (Ramadan). Data collection may have been affected by factors related to this observance such as reduced working hours and type of patients showing up for

appointments during this month. The study is a hospital-based study conducted in only one specialized hospital. Thus, in order to generalize the results, the study might need to involve patients from other hospitals or be conducted in a non-specialized or public setting. Another limitation in the study was the self-reporting of HA1C results. Because we depended on patients to report this data, and it wasn't feasible to obtain HA1C measurements directly due to unavailability of resources and due to the nature of the study, we ended up with 65% of the responses to this important question missing. We had very limited access to medical records, which was a barrier to obtaining important clinical and laboratory data.

Chapter 6: Conclusion

The increasing incidence of diabetes in Saudi Arabia is a major health concern for the Saudi Ministry of Health; it has quantifiable financial implications. As such, control of diabetes to avoid development of related complications is necessary. As noted, a high percentage of respondents sought their first eye check-up due to doctor's referral, but even patients with medical referrals were not receiving check ups within the timeframe of the national guidelines or at the optimal frequency for preventing complications and maintaining the best eye health. Lack of knowledge about diabetes-related complications is a barrier to seeking timely diagnosis and treatment. In this regard, there is a need to emphasize education about diabetes and related complications and actively motivate diabetics to seek out ophthalmological evaluation. Not only does education have an impact on knowledge, it has also been shown to impact health behaviors.

With regards to awareness of other diabetes-related complications, most patients in

our study understood the connection between diabetes and eye disease; however, the majority did not know that there was an association between diabetes and stroke or peripheral vascular disease. Therefore, mass media messaging could be effective in raising awareness.

The strength of mass media comes from its ability to raise current, important health issues that reflect the public's concerns. Despite the relatively high expense of production, the cost per person reached is lower than for other methods like face to face communication. For the most effective outcomes, health messages delivered through mass media should be fixed, simple, creative, use different formats, and be repeated many times. While mass media has proven to be an effective tool for providing health information, messages delivered through TV, internet, radio, and newspapers are unlikely to change behavior or develop skills but at least can provide the recipient with the right information, which is an important step to increase the level of awareness in the community. [30]

Tables and Figures

Table 1: Demographic characteristics of the 380 study participants (N,%)

Age (y)	
0-45	31 (8.2%)
45-55	86 (22.6%)
55-65	154 (40.5%)
65 and above	109 (28.7%)
Sex	
Male	181 (47.6%)
Female	199 (52.4%)
Nationality	
Saudi	332 (87.4)
Non Saudi	48 (12.6)
Residency	
Inside Jeddah	291 (76.6%)
Outside Jeddah	89 (23.4)
PHCC	
Follow up	255 (67.1%)
Not follow up	125 (32.9%)
Educational level	
Illiterate	168 (44.2%)
Primary school	70 (18.4%)
Preparatory school	146 (12.1%)
Secondary school	49 (12.9%)
University and higher degree	47 (12.4%)

Table 2: Association between different clinical variables and gender (N,%)

	Female	Male	Total	P-value
Diabetes Type				
Type 1	15 (8.3%)	8 (4.0%)	23 (6.1%)	
Type 2	159 (87.8%)	182 (91.5%)	341 (89.7%)	0.217
Unknown	7 (3.9%)	9 (4.5%)	16 (4.2%)	
Use of Insulin				
Yes	79 (43.9%)	79 (40.1%)	158 (41.9%)	0.45
No	101 (56.1%)	118 (59.9%)	219 (58.1%)	
Seen by doctor past 12 months				
Yes	168 (92.8%)	181 (91.0%)	349 (91.8%)	0.326
No	13 (7.2%)	18 (9.0%)	31 (8.2%)	
Follow up recommendation				
<4 visits in the last 12 months	76 (43.7%)	62 (31.8%)	138 (37.4%)	0.015
≥4 visits in the last 12 months	98 (56.3%)	133 (68.2%)	231 (62.6%)	
Glucose check up frequencies				
Never	31 (17.3%)	26 (13.1%)	57 (15.1%)	
<4 times a day	46 (25.7%)	78 (39.2%)	124 (32.8%)	
>4 times a day	6 (3.4%)	2 (1.0%)	8 (2.1%)	0.196
<4 times a month	31 (17.3%)	34 (17.1%)	65 (17.2%)	
>4 times a month	61 (34.1%)	58 (29.1%)	119 (31.5%)	
Rarely	4 (2.2%)	1 (0.5%)	5 (1.3%)	
Eye screening referral				
Yes	121 (33.2%)	134 (67.3%)	255 (67.1%)	0.784
No	60 (66.8%)	65 (32.7%)	125 (32.9%)	
Time between diagnosis and eye screening				
Between 0-10 years	79 (44.6%)	73 (37.6%)	152 (41.0%)	0.219
Between 10-20 years	51 (28.8%)	72 (37.1%)	123 (33.1%)	
>20 years	47 (26.6%)	49 (25.3%)	96 (25.9%)	
Wear eyeglasses or contact lenses				
Yes	109 (60.2%%)	129 (65.5%)	238 (62.9%)	0.259
NO	72 (39.8%)	68 (34.5%)	140 (37.1%)	
Last eye examination				
Never	14 (7.8%)	15 (7.5%)	29 (7.6%)	
Don't know/Not sure	8 (4.4%)	4 (2.0%)	12 (3.2%)	0.29
Within past year	142 (78.9%)	169 (85.0 %)	311 (82.1%)	
>One year	16 (8.9%)	11 (5.5%)	27 (7.1%)	
Retinopathy				
Yes	119 (66.1%)	134 (67.7%)	253 (66.9%)	
No	55 (30.6%)	56 (28.3%)	111 (29.4%)	0.739
Don't know/Not sure	6 (3.3%)	8 (4.0%)	14 (3.7%)	

HA1C				
>6.5%	52 (96.3%)	76 (96.2%)	128 (96.2%)	0.978
<6.5%	2 (3.7%)	3 (3.8%)	5 (3.8%)	

Table 3: Knowledge about diabetes complications

Complication	Yes	%	No	%	Do Not Know	%
Coronary artery disease	246	64.7	65	17.1	69	18.2
Stroke	228	60.2	72	19.0	79	20.8
Peripheral Vascular disease	236	62.3	61	16.1	82	21.6
Neuropathy	259	68.5	67	17.7	52	13.8
Eye Disease	351	92.4	19	5.0	10	2.6
Nephropathy	269	70.8	69	18.2	42	11.0

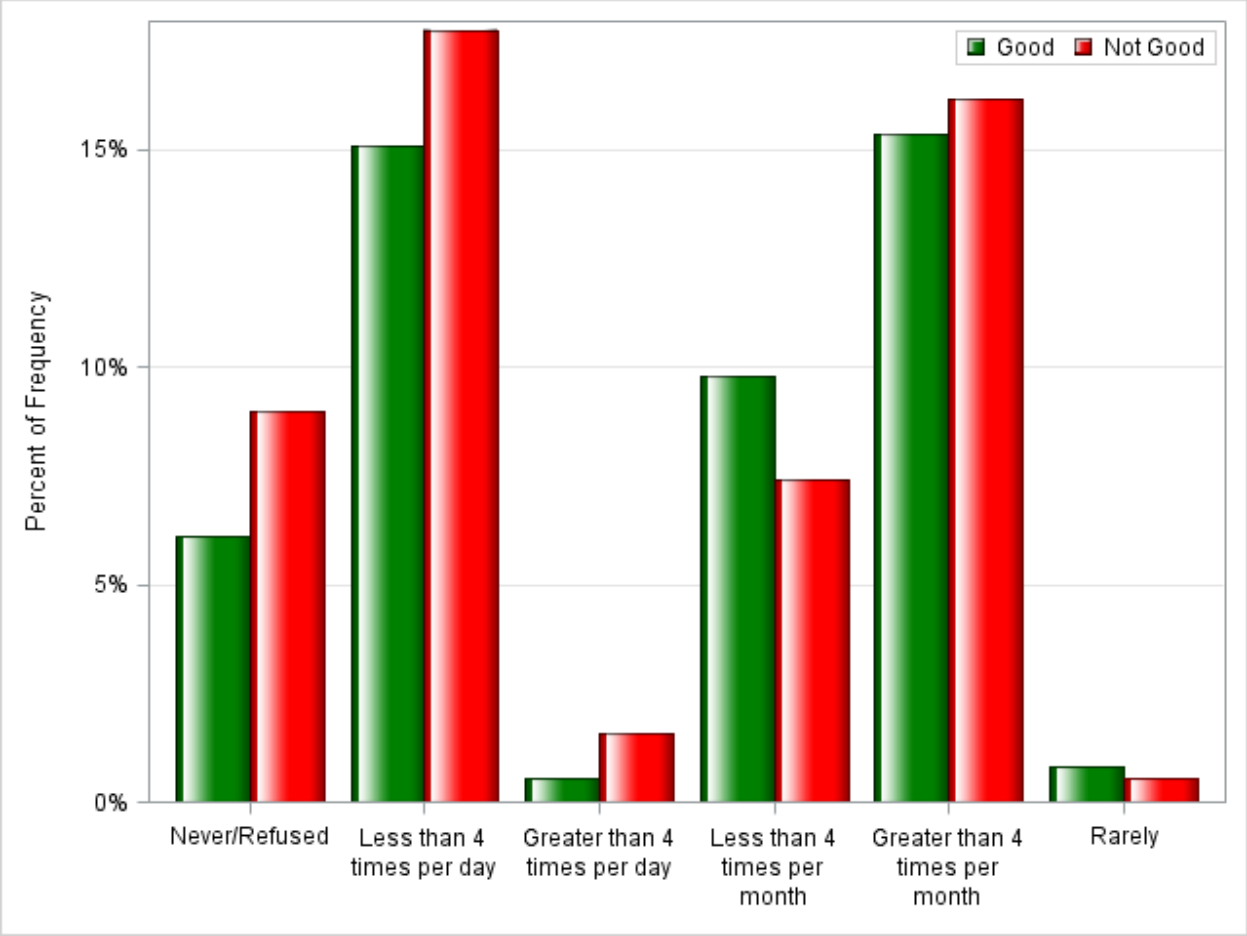

Figure 2: Blood glucose test frequencies classified by patients' impression of whether or not their diabetes is under good control or not

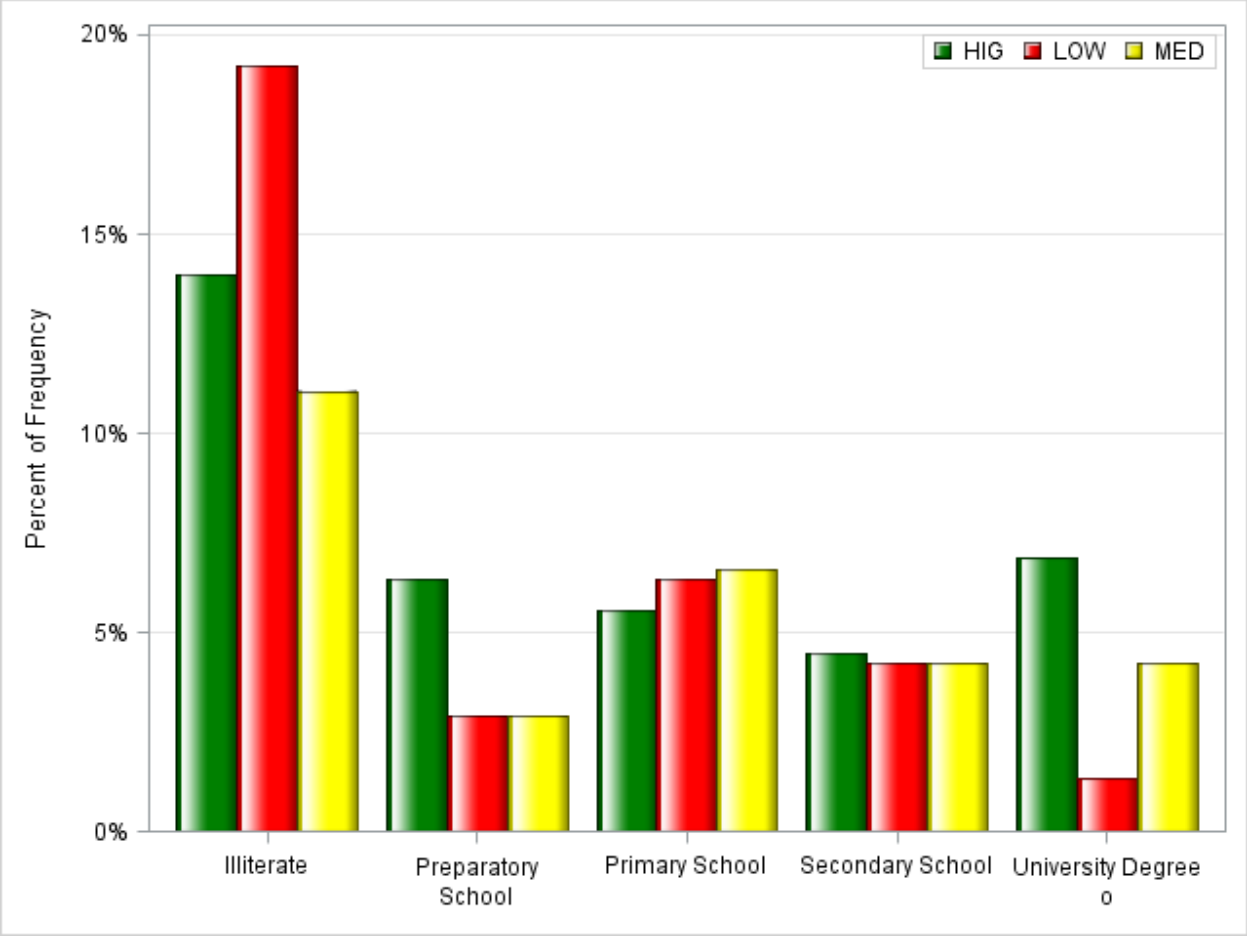

Figure 3: Level of awareness by educational level

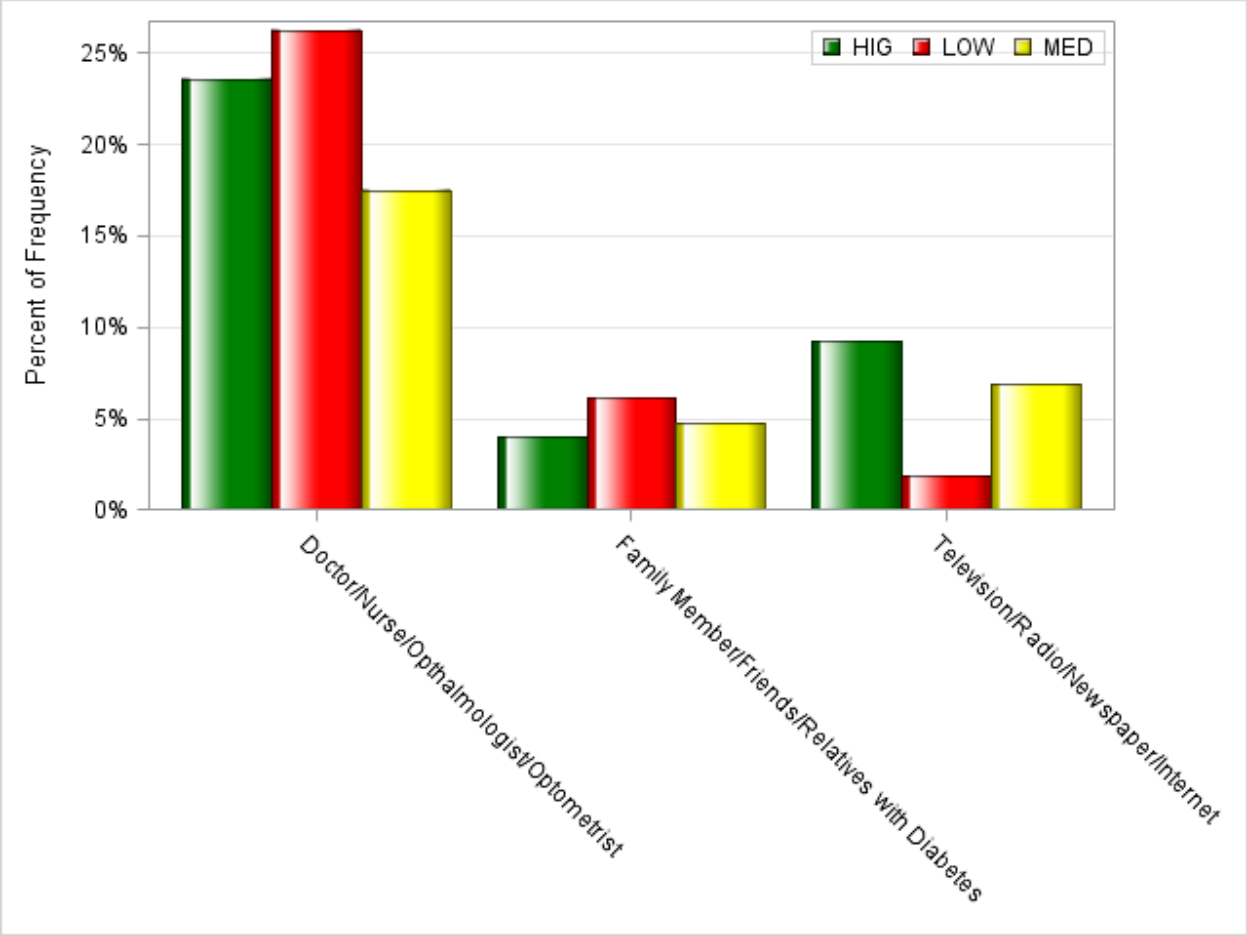

Figure 4: Level of awareness by source of knowledge

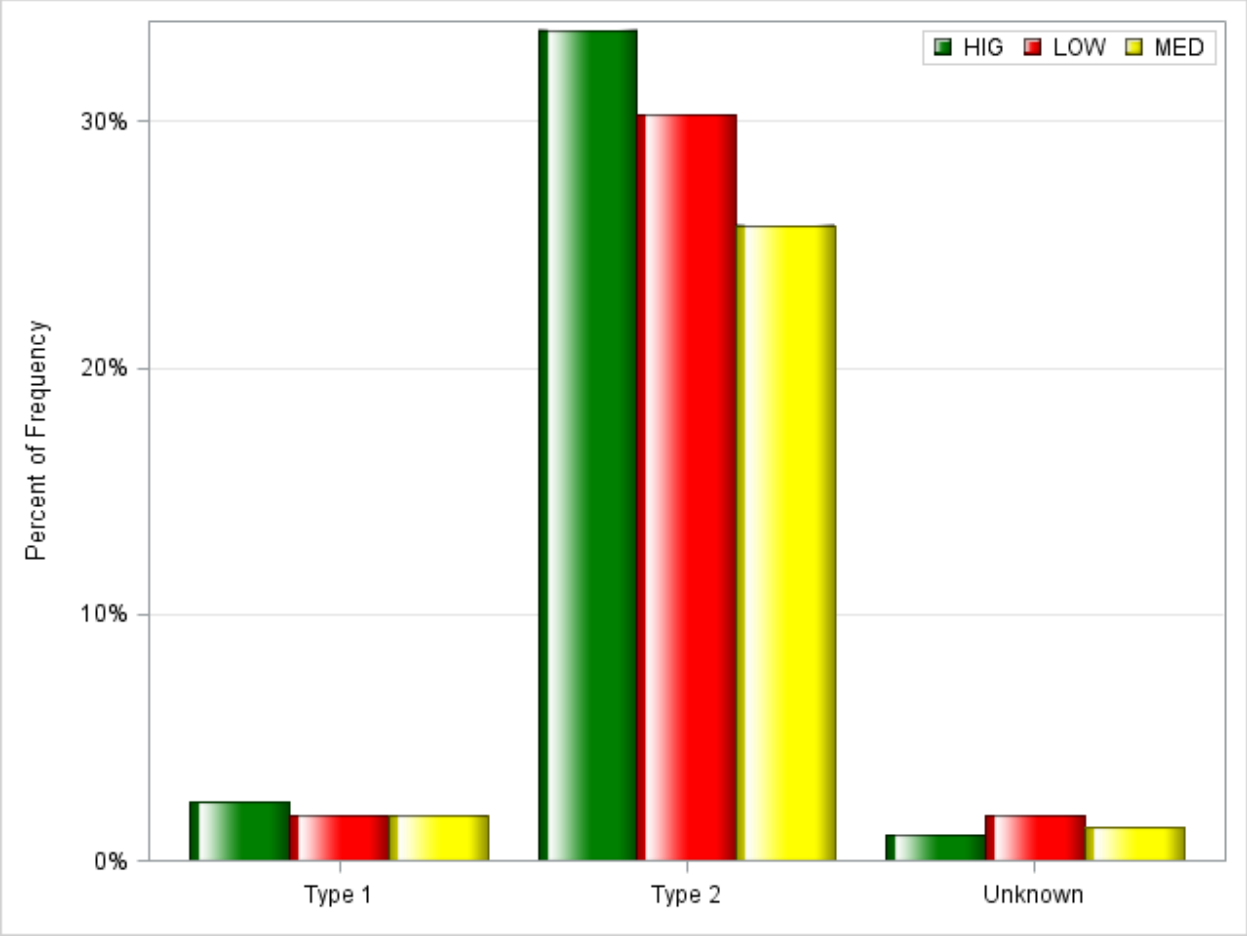

Figure 5: Level of awareness by type of diabetes

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Appendix

Appendix 1: Questionnaire (English)

1. Age _____
2. Sex:
    a. Male
    b. Female
3. Nationality:
    a. Saudi
    b. Non Saudi, specify _____
4. Area of residence:
    a. Inside Jeddah
    b. Outside Jeddah, specify_____
5. Primary health care center (PHCC):
    a. Name of the PHCC that you follow up in _____
    b. I don't follow up in any PHCC
6. Educational level:
    a. Illiterate
    b. Primary school
    c. Preparatory school
    d. Secondary school
    e. University degree
    f. Other, Specify _____
7. Type of diabetes:
    a. Type 1
    b. Type 2
    c. Unknown
8. How old were you when you were told you have diabetes?
    a. Age in years _____
    b. Don't know / Not sure
    c. Refused [1]
9. Are you now taking insulin?
    a. Yes
    b. No
    c. Refused [2]
10. Have you ever seen a doctor, nurse, or other health professional for your diabetes in the past 12 months?
    a. Yes
    b. No

(*If the answer of the previous question was (yes) go to question 11, if (no) go to question 12*)

11. About how many times in the past 12 months have you seen a doctor, nurse, or other health professional for your diabetes?
    a. Number of times _____
    b. Don't know / Not sure
    c. Refused [2]
12. About how often do you check your blood for glucose or sugar?

(Include times when checked by a family member or friend, but do NOT include times when checked by professional)

a. Times per day _____
b. Times per week _____
c. Times per month _____
d. Times per year _____
e. Never
f. Don't know / Not sure
g. Refused [2]

13. Have you ever receive a referral for eye screening?
    a. Yes
    b. No

(*If the answer of the previous question was (yes) go to question 14, if (no) go to question 15*)

14. What is the time between diagnosis and referral for eye screening?
    a. Month(s) _____
    b. Year(s) _____
15. Are you were eyeglass or eye contact lenses?
    a. Yes
    b. No
16. When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light.

Read only if necessary:

a. Within the past month (anytime less than 1 month ago)
b. Within the past year (1 month but less than 12 months ago)
c. Within the past 2 years (1 year but less than 2 years ago)
d. 2 or more years ago

Do not read:

e. Don't know / Not sure
f. Never
g. Refused [2]

17. Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy?
    a. Yes
    b. No
    c. Don't know / Not sure
    d. Refused [2]
18. HA1C level at the time of referral
    a. The result _____
    b. Not done

<u>Questions related to diabetes, diabetic eye diseases and appropriate eye care-seeking behavior [3]</u>

19. Which of the following complication/s may arise if diabetes is poorly controlled?
    a. Coronary artery disease (Yes/No/Do not know)
    b. Stroke (Yes/No/Do not know)
    c. Peripheral vascular disease (Yes/No/Do not know)
    d. Neuropathy (Yes/No/Do not know)
    e. Eye Disease (Yes/No/Do not know)
    f. Nephropathy (Yes/No/Do not know)

20. How did you come to know about this/these complication/s?
    a. Doctor/nurse/ophthalmologist/optometrist
    b. Family member/friends/relatives with diabetes
    c. Television/radio/newspaper/internet
21. How good do you think your blood sugar control is?
    a. Good
    b. Not good
22. Does a diabetic patient need to have eye checkup when his/her blood sugar level is well controlled?
    a. Yes
    b. No
    c. Some times
23. How frequently should a person with diabetes undergo an eye checkup?
    a. Every 6 months
    b. Yearly
    c. Two yearly
    d. Only when vision affected
24. Do you know what are the treatments available for diabetic retinopathy?
    a. Good control of diabetes alone is adequate
    b. Laser treatments
    c. Surgery
    d. Do not know
25. What are the reasons that make you undergo first eye screening?
    a. Doctor's referral
    b. Self-awareness
26. What do you think was the biggest barrier for not getting eye screening earlier?
    a. Lack of knowledge on diabetic eye disease
    b. Lack of access to eye care
    c. Cost/insurance issue
    d. Time limitations
    e. Fear of discovering something bad

Appendix 2: Questionnaire (Arabic)

1 العمر : _____
2 الجنس :
a. ذكر
b. أنثى
3 الجنسية :
a. سعودي
b. غير سعودي ,حدد _____
4 مكان الإقامة :
a. داخل جدة
b. خارج جدة ,حدد _____
5 مركزالرعاية الصحية الأولية :
a. إسم المركز الصحي اللذي تتبع له _____
b. ليس لدي ملف في أي مركز صحي
6 المستوى التعليمي :
a. غير متعلم
b. إبتدائي
c. متوسط
d. ثانوي
e. جامعي
f. مستوى أخر ,حدد _____
7 نوع مرض السكري :
a. سكري من النوع الأول
b. سكري من النوع الثاني
c. غير معروف
8 كم كان عمرك عندما تم إخبارك أنك مصاب بالسكري ؟
a. العمر بالسنوات _____
b. لا أعرف / غير متأكد
c. رفض الإجابة
9 هل تستخدم الإنسولين لعلاج السكري حاليا ؟
a. نعم
b. لا
c. رفض الإجابة
10 هل قمت برؤية طبيب, ممرض, أو ممارس صحي بخصوص مرض السكري خلال الإثني عشر شهر الماضية ؟
a. نعم
b. لا
(إذا كانت الإجابة بنعم أكمل السؤال 11 , وإذ كانت الإجابة بلا توجه مباشرة الى السؤال 12)
11 كم عدد المرات اللتي قمت فيها بزيارة طبيب أو رؤية ممرض أو ممارس صحي بخصوص مرض السكري خلال الإثني عشر شهر الماضية ؟
a. عدد المرات _____
b. لا أعرف / غير متأكد
c. رفض الإجابة

12 كم عدد المرات اللتي تقيس فيها مستوى السكر في الدم عادة ؟ (تتضمن الإجابة عدد المرات اللتي يتم فيها قياس السكر من قبل المريض نفسه أو من قبل أحد أفراد الأسرة, ولا تتضمن عدد المرات اللتي يقاس فيه السكر من قبل ممارس صحي)

a. عدد المرات في اليوم _____
b. عدد المرات في الأسبوع _____
c. عدد المرات في الشهر _____
d. عدد المرات في السنة _____
e. لا أقيس أبدا
f. لا أعرف / غير متأكد
g. رفض الإجابة

13 هل تم تحويلك من قبل من أجل فحص العين الخاص بمرضى السكري ؟

a. نعم
b. لا

(إذا كانت الإجابة بنعم أكمل السؤال 14 , وإذ كانت الإجابة بلا توجه مباشرة الى السؤال 15)

14 كم كانت المدة بين تشخيص إصابتك بالسكري وتحويلك لعمل فحص العين الخاص بمرضى السكري ؟

a. ____ شهر
b. ____ سنة

15 هل ترتدي نظارات أو عدسات لاصقة طبية ؟

a. نعم
b. لا

16 متى كانت أخر مرة حصلت فيها على فحص عين تم فيه عمل توسيع لحدقة العين ؟ (عملية التوسيع تتم بواسطة قطرة خاصة تجعل العين تتحسس للضوء مؤقتا)

a. خلال الشهر الماضي(أقل من شهر)
b. خلال السنة الماضية (أكثر من شهر وأقل من 12 شهر)
c. خلال السنتين الماضية (أكثر من سنة وأقل من سنتين)
d. سنتين أو أكثر
e. لا أعرف / غير متأكد
f. أبدا
g. رفض الإجابة

17 هل أخبرك الطبيب سابقا أن مرض السكري قد أثر على عينيك أو أنك مصاب بإعتلال الشبكية السكري؟

a. نعم
b. لا
c. لا أعرف /غير متأكد
d. رفض الإجابة

18 مستوى الهيموجلوبين السكري (التراكمي) وقت الزيارة :

a. النتيجة _____
b. النتيجة غير معلومة / لم يتم عمل الفحص

<u>الأسئلة المتعلقة بمدى وعي المريض بمرض السكري والسلوك الصحي المتعلق بطلب الخدمة</u>

19 أي من الضاعفات التالية من الممكن حدوثه في حالة عدم التحكم بمرض السكري ؟

a. أمراض القلب والشرايين (نعم / لا / لا أعرف)
b. الجلطات (نعم / لا / لا أعرف)
c. أمراض الأوعية الدموية الطرفية (نعم / لا / لا أعرف)
d. أمراض الأعصاب (نعم / لا / لا أعرف)
e. أمراض العيون (نعم / لا / لا أعرف)
f. أمراض الكلى (نعم / لا / لا أعرف)

20 ماهو مصدر معرفتك بهذه المضاعفات ؟

a. الطبيب / الممرض /طبيب العيون
b. فرد من العائلة / صديق / قريب مصاب بالسكر
c. التلفيزيون / الراديو / الصحف / الإنترنيت

21 هل تعتقد أن التحكم بمستوى السكر لديك جيد ؟
a. جيد
b. غير جيد

22 هل تعتقد أن مريض السكري بحاجة لعمل فحص العين إذا كان معدل السكر لديه متحكم به كما يجب ؟
a. نعم
b. لا
c. أحيانا

23 كم هي الفترة الزمنية اللتي يجب ان يتم فيها دوريا فحص اعتلال الشبكية لمريض السكري في إعتقادك ؟
a. كل 6 شهور
b. كل سنة
c. كل سنتين
d. عند تأثر النظر فقط

24 هل تعرف العلاجات المتوفرة لإعتلال الشبكية السكري ؟
a. التحكم بمستوى سكر الدم كافي كعلاج
b. العلاج بالليزر
c. الجراحة
d. لاأعرف

25 ماهو السبب اللذي جعلك تقوم بأول فحص للعين بعد إصابتك بالسكري ؟
a. تحويل الطبيب المعالج
b. الوعي الذاتي

26 في إعتقادك ماأكثر العوائق لعدم القيام بفحص العين في وقت مبكر ؟
a. عدم المعرفة بمضاعفات مرض السكري على العين
b. عدم توفرخدمة فحص العين بسهولة
c. التكلفة / مشاكل التأمين
d. ضيق الوقت
e. الخوف من إكتشاف مشكلة طبية في العين