

Survey on the awareness of diabetic retinopathy among people with diabetes in the Songnan community of Shanghai

Yi Xiong¹, Li-Ping Liu², Yan Chen², Jie Zhao¹

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¹Department of Ophthalmology, Baoshan Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai 201900, China

²Community Health Service Center of Songnan, Shanghai 200439, China

Correspondence to: Jie Zhao. Department of Ophthalmology, Baoshan Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai 201900, China. 13761231212@163.com

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上海淞南社区糖尿病患者对糖尿病视网膜病变的认知度调查

熊毅¹, 刘丽萍², 陈雁², 赵婕¹

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(作者单位:¹201900 中国上海市曙光医院宝山分院眼科;
²200439 中国上海市淞南社区卫生服务中心)

作者简介: 熊毅, 复旦大学公共卫生学院 MPH 硕士, 主治医师, 研究方向: 白内障, 屈光斜弱视, 眼整形, 慢性病防治。

通讯作者: 赵婕, 毕业于上海第二医科大学, 硕士, 副主任医师, 研究方向: 白内障, 眼底病. 13761231212@163.com

摘要

目的: 调查上海淞南社区糖尿病患者糖尿病视网膜病变 (diabetic retinopathy, DR) 的患病率及其防治知识认知度的现况和影响因素。

方法: 采用整体随机抽样的方法, 对上海淞南社区的糖尿病患者进行全身体检。免散瞳眼底照相了解 DR 患病率。填写调查问卷了解其一般情况和对 DR 的认知度情况。

结果: 共收集有效调查问卷和眼底照相 1 120 份。糖尿病患者 DR 患病率为 23.6%, 其中轻度 DR 17.1%, 中度 DR 5.1%, 重度 DR 1.4%。最近 1a 中做过眼科检查者 14.1%; 知道空腹血糖正常值者占 71.5%; 85.7% 的患者知道糖尿病会引起全身并发症; 77.2% 的患者知道有眼部并发症; 47.9% 的患者知道需要定期检查眼底; 58.0% 的

患者知道早期治疗 DR 是防治视力损伤的重要手段; 59.9% 的患者愿意定期参加健康宣教讲座。单因素相关分析提示: 对 DR 知识认知度得分与年龄、文化程度、医保类型、糖尿病病程、是否控制饮食、是否监测血糖、空腹血糖水平、锻炼频次和 DR 分期相关。Logistic 回归分析提示对 DR 知识认知度得分的影响因素为: 年龄、文化程度、医保类型、糖尿病病程、是否控制饮食、锻炼频次和 DR 分期。

结论: 淞南社区糖尿病患者对 DR 防治知识的认知度尚不足, 认知没有完全付诸行动, 对社区糖尿病患者进行有针对性的 DR 防治知识宣教很有必要。

关键词: 糖尿病; 糖尿病视网膜病变; 认知度

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Abstract

• **AIM:** To investigate the prevalence and awareness of diabetic retinopathy (DR), as well as its influential factors, among patients with diabetes mellitus in the Songnan Community of Shanghai.

• **METHODS:** Residents with diabetes mellitus were randomly sampled in Shanghai's Songnan Community. These patients received full physical examinations. DR was diagnosed using non-mydriatic fundus photography. The patients completed a survey concerning their general knowledge and awareness of DR.

• **RESULTS:** A total of 1120 valid questionnaires and fundus photographs were collected. The incidence of DR among patients with diabetes was 23.6%; 17.1% had mild DR, 5.1% had moderate DR and 1.4% had severe DR. Of the survey participants, 14.1% received ophthalmic examinations over the last year, 71.5% knew their normal blood glucose levels, 85.7% were aware of the possibility of systemic complications caused by diabetes, 77.2% were aware of ocular complications, 47.9% were aware of the need for regular fundus examinations, 58.0% were aware that the early treatment of DR is an important measure to prevent visual impairment, and 59.9% were willing to participate in regular health education seminars. A univariate analysis indicated that the knowledge and awareness scores regarding DR were correlated with age, education level, type of medical insurance, duration of diabetes, diet control, blood glucose monitoring, fasting

blood glucose level, exercise frequency and DR stage. A logistic regression analysis indicated that the factors affecting the DR awareness scores were age, education level, type of medical insurance, stage of diabetes, diet control, exercise frequency and DR stage.

• **CONCLUSION:** The patients with diabetes in the Songnan Community lacked sufficient awareness of DR prevention and treatment methods. The existing awareness of DR among the survey participants did not lead to effective prevention or treatment actions associated with this condition. It is necessary to educate patients with diabetes in local communities regarding DR.

• **KEYWORDS:** diabetes; diabetic retinopathy; awareness
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INTRODUCTION

Diabetic retinopathy (DR) has become a major blinding ocular disease among people aged 20 – 60 years old worldwide^[1]. Approximately 14.6% of people aged above 40 who had diabetes for over 5y are estimated to have DR, leading to 15000 to 39000 cases of complete vision loss. The blindness caused by DR is “avoidable blindness”. Regular DR screenings and interventions for risk factors can prevent the occurrence of DR^[2]. The results from clinical studies of diabetes control and complications in the US have demonstrated that education regarding diabetes and active cooperation from patients are the basis from which good control of diabetic complications^[3].

To establish health management records for DR in the Songnan Community of Shanghai, a survey was conducted regarding DR awareness as well as the knowledge of its prevention and treatment among patients with diabetes. Through an impact factor analysis, this survey intended to identify the bottleneck regarding DR awareness among patients with diabetes (*i. e.* the focus of DR – related health education in local communities) and provide a scientific basis for health management strategies targeted at health education and the observation of intervention effects. In this study, patients with diabetes in the Songnan Community of Shanghai received general physical and ophthalmology examinations and completed a survey regarding their general information and awareness of DR-related knowledge.

SUBJECTS AND METHODS

Participants Between March and September 2013, patients in the diabetes management records of Songnan Community were selected using a cluster sampling method to participate in this study. A total of 1120 participants volunteered to

complete this survey. All participants signed informed consent documents.

Methods

Questionnaire All surveyors received standardized training. A epidemiological questionnaire of international standards was adopted to obtain general participant information, including their names, gender, age, education level, annual income, type of medical insurance, diabetes duration, medical history concerning ophthalmological conditions, blood glucose monitoring, smoking habits, alcohol consumption, history of hypertension, exercise frequency and awareness of DR – related knowledge.

The questionnaire was designed to examine whether patients with diabetes had grasped the key points of DR prevention and treatment, such as the concept of DR, awareness of the importance of fundus examinations from physicians, awareness of the relationship between blood glucose level and DR, ophthalmological treatments and disease causes, to understand the current status of DR awareness among patients with diabetes in the Songnan Community. A total of 1120 valid questionnaires were received.

Physical examination All participants received standard physical examinations, including height and weight measurements. Body mass index (BMI) was calculated based on body height and weight [$BMI = \text{weight (kg)} / \text{height}^2 \text{ (m)}$]. According to the body weight criteria for Chinese adults published by the National Health and Family Planning Commission of the People’s Republic of China in 2013, “underweight” denoted a BMI lower than 18.5, “normal weight” represented a BMI between 18.5 and 23.9, “overweight” denoted a BMI between 24.0 and 27.9, and “obese” represented a BMI of at least 28.0. Resting blood pressure was measured. Hypertension was diagnosed when patients’ systolic blood pressure was at least 140mmHg or their diastolic pressure was at least 90mmHg. Hypotension was diagnosed when patients’ systolic pressure was no more than 90mmHg or their diastolic pressure was no more than 60mmHg.

Biochemical tests Venous blood was collected in the morning after the participants had fasted for 10–12h following dinner the night before. Fasting blood glucose was tested using a Hitachi 7060 fully automatic biochemical analyzer.

Ophthalmic examination Uncorrected distance visual acuity and visual acuity with pinhole were examined using an international – standard logarithmic visual acuity chart. Two 35° retinal color photographs of the fundus posterior pole were taken using a non – mydriatic fundus digital camera (NIDEKNU – 1000, Nidek, Japan). The photographs were examined by one ophthalmologist and reviewed by another to determine the type of DR. According to the International Clinical DR Disease Severity Scale published in October 2002, the participants were reclassified into the following categories:

Table 1 Correct answers to the survey questionnaire

Questions	No. of participants with correct answers	Awareness rate (%)
Are you aware of the normal range for fasting blood glucose level?	801	71.5
Are you aware of the possibility of the systemic complications caused by diabetes?	959	85.7
Are you aware of the possibility of the ocular complications caused by diabetes, such as diabetic retinopathy (fundus pathological changes)?	865	77.2
Are you aware of the possibility of ocular complications among patients with diabetes with well-controlled blood glucose level?	382	34.1
Did your doctor remind you of your fundus exam?	530	47.4
Did you know that controlling your blood glucose level, blood pressure and blood lipid level is necessary to prevent and treat diabetic retinopathy?	526	47.0
Did you know that the early treatment of diabetic retinopathy is an important measure to prevent and treat visual impairment and blindness?	649	58.0
Did you know that routine annual fundus exams are necessary for patients with diabetes?	536	47.9
Did you know that untreated diabetic retinopathy could lead to blindness?	922	82.3
Are you willing to attend seminars on diabetes?	671	59.9

Table 2 Survey regarding the reasons for scheduling the ophthalmology examination over the last year *n*(%)

Groups	Ophthalmology exam over the last year	Reasons		
		Reminded by physician	Routine physical exam	Decreased vision
Total	158	12 (7.6)	40 (25.3)	106 (67.1)
DR group	37	4 (10.8)	14 (37.8)	19 (51.4)
Non-DR group	121	8 (6.6)	26 (21.5)	87 (71.9)

no apparent DR, mild non-proliferative DR, moderate non-proliferative DR, severe non-proliferative DR and proliferative DR. Participants with DR in both eyes were graded according to the eye with more severe DR.

Statistical Analysis Specific personnel conducted data collection, registration, sorting and storage. Specifically appointed staff inspected and recovered the data following each survey activity. A database was established with data entry quality control via parallel double entry and logic-based error detection. The data analysis was performed using SPSS 17.0. A univariate analysis of variance was performed on the enumeration data using the χ^2 test, followed by a screening for the factors related to DR awareness using multivariate logistic regression model. $P < 0.05$ was considered significant.

RESULTS

Diabetic Retinopathy Prevalence Of the 1120 participants, 508 were men, and 612 were women. The mean age was 58.2 (range 36 to 72). The DR rates were 23.6% (264 cases) in total, 24.0% (122 cases) in men and 23.2% (142 cases) in women. The difference between men and women with regard to DR prevalence was not significant ($P > 0.05$). The rates of mild non-proliferative DR, moderate non-proliferative DR, severe non-proliferative DR and proliferative DR were 17.1% (191 cases), 5.1% (57 cases), 1.2% (13 cases) and 0.2% (3 cases), respectively.

Summary of the Diabetic Retinopathy Awareness

Questionnaire

Correctly answered awareness questionnaires A total of 1120 valid questionnaires were received (recovery rate of 95.2%). The questionnaire consisted of 10 questions, with 10 points for each question and a total score of 100 points. The numbers of participants who correctly answered each question are shown in Table 1. For the first question “Are you aware of the normal range for fasting blood glucose level?”, an answer indicating the upper limit of 6.1mmol/L was considered correct.

Ophthalmic examination over the last year The questionnaire determined whether they had received an ophthalmic examination over the last year and the reasons for scheduling this exam. The results are shown in Table 2.

Correlation analysis of the factors on the awareness questionnaire The average score of the 1120 awareness questionnaires was 61.1. Questionnaires that scored 50 points or less were categorized as the low-score group, and those that received 60 points or more were categorized as the high-score group. A chi-square test was performed for a univariate correlational analysis of the questionnaire scores with gender, age and other general information.

The univariate analysis of the awareness score showed that DR awareness was related to age, education level, medical insurance type, diabetes duration, diet control, blood glucose level monitoring, fasting blood glucose level, exercise frequency and DR stage as well as unrelated to gender, annual

Table 3 Logistic regression analysis using the factors that affect DR awareness scores

Factors	β	<i>P</i>	OR (95% CI)
Age	-0.0735	0.0000	0.9292 (0.6554, 1.3173)
Education	0.6095	0.0000	1.8396 (0.9825, 3.4442)
Medical insurance	0.4678	0.0056	1.5964 (0.9244, 2.7570)
Duration of diabetes	0.5596	0.0000	1.7500 (1.2321, 2.4856)
Diet control (Y/N)	0.7648	0.0000	2.1485 (1.4756, 3.1284)
Exercise frequency	0.0857	0.0058	1.0894 (0.4372, 2.7149)
DR stage	0.5859	0.0255	1.7966 (1.2302, 2.6237)

household income, ophthalmic examination over the last year, alcohol consumption, smoking habits, BMI, hypertension history, blood pressure control and vision.

The awareness – score – related variables were included in a logistic regression analysis, and the results are shown in Table 3. The logistic regression analysis showed that the factors that affected the awareness score were age, education level, medical insurance type, diabetes duration, diet control, exercise frequency and DR stage. In other words, younger patients with more education, lower medical insurance reimbursement rates, longer diabetes durations, more frequent exercise and more severe DR stages had higher DR awareness scores; moreover, patients on diet control scored higher than those not on diet control.

DISCUSSION

The Songnan community is located in the Baoshan District of Shanghai; its area is 13.7 square kilometers. This district is a suburban region with a growing population. It has a greater number of elderly people than the city average, and its income level is relatively low. The community has approximately 100000 permanent residents and a floating population of 20000. A total of 10005 permanent residents, 40 to 80 years old, were surveyed between June and August 2008 at a health examination. The results of the survey showed that the prevalence of diabetes was as high as 9.9% in this community, and 3.2% of patients with diabetes did not have any lifestyle interventions or use drug treatments. The Songnan Community Health Service Center established and electronically manages the health records of 91.4% of the community, forming a relatively comprehensive health service network.

Currently, the data of more than 4000 patients with diabetes in the Songnan community have been archived and managed. DR prevention via the community health management network coverage can save considerable time, transportation and medical costs as well as greatly improve patient compliance regarding diabetes screening. Timely education regarding eye disease will likely have a profound effect on enhancing the efficiency of prevention and treatment programs for blindness, improve quality of life, and reduce the family and social burdens caused by DR^[4]. The community blindness

prevention project regarding DR undertaken by the Beixinjing neighborhood of Shanghai between 2005 and 2007 showed that the proportion of stable or improved DR diagnoses reached 92.5%^[5], and 0.03 quality-adjusted life years (QALYs) were gained per person in the DR intervention group compared with their pre – intervention status. This program was also cost effective^[6].

The DR prevalence ranged from 20.5% – 46.9% in a community – based diabetic population^[7-9]. In the current study, the DR prevalence was 23.57% among patients with diabetes in the Shanghai Songnan community. The domestic DR epidemiology survey has mostly focused on prevalence^[10-13]. With regard to the subjective aspects of DR awareness among patients with diabetes, the surveyed participants were usually patients with diabetes who sought treatment from endocrinology or ophthalmology departments^[14,15] and already suffered from systemic or ocular symptoms. Thus, early asymptomatic patients are easily neglected, and the significance of preventive disease treatments is not reflected.

Based on previous international studies, patients with diabetes lacked sufficient DR awareness. An Australian survey showed that 37% of patients with diabetes had DR – related knowledge^[16], whereas and this awareness rate was 65% in the United States^[17] and 27% in India^[18]. A Malaysian survey showed that 68.6% of patients with diabetes were unfamiliar with DR prevention and treatment methods^[19].

The current study found that 918 participants (82.3%) knew that DR can cause blindness, whereas only 646 participants (58.0%) were aware of the need for early treatment, which indicates that most patients with diabetes understand the harm of DR but lacked an understanding of the key to preventing blindness: early treatment.

Although 71.5% of the patients with diabetes knew the normal range for fasting blood glucose level, more patients (85.7%) knew that diabetes can cause systemic complications, which indicates that most patients with diabetes were familiar with diabetes-related knowledge. This finding reflects the effectiveness of the community diabetes management in the Songnan community since 2008. Only a minority (34.1%) of the patients with diabetes were aware of

the possible pathogenesis of ocular complications even when blood glucose is well controlled, and 47.0% of the patients understood that the control of blood glucose, blood pressure and blood lipid is necessary to prevent DR. These findings suggest that patients with diabetes lack an awareness of the relationship between diabetic ocular diseases and systemic complications. These results also suggest that the content of the current community-based education should be broadened, and the education regarding diabetes complications and general knowledge should be improved.

The survey showed that 59.9% of the patients with diabetes were willing to attend seminars on diabetes, whereas 40.09% believed that they had sufficient understanding of the disease or preferred to acquire knowledge through other channels. These findings indicate that participation in community-based health education programs requires additional improvement.

Of the 264 patients with diabetes in the DR group, only 4 (1.5%) knew that they had DR; on the other hand, of the 856 patients in the non-DR group, five (0.6%) knew that they had DR. These results suggest that community screenings might effectively locate many DR patients who are unaware of their condition. These data also suggest that the DR awareness of patients with diabetes was not accurate, which might have resulted in the finding that most patients in the DR group did not know that they had DR, whereas some patients in non-DR group thought that they had this disease. The limitations concerning non-mydratric fundus photography might have also caused errors in the survey results.

Although the DR awareness questionnaire showed that 865 (77.2%) patients with diabetes were aware of the ocular complications caused by diabetes, and 536 (47.9%) were aware of the need for annual fundus examinations, only 158 (14.1%) participants actually had these examinations. A total of 530 participants (47.4%) admitted that their doctors or general practitioners recommended fundus examinations, but the major reason for undergoing this examination was vision loss, which accounted for 67.1% (106) of all fundus examinations. Lewis *et al*^[20] also showed that most DR patients were not aware of their DR until they were tested for vision loss at a clinical setting, which indicates that the awareness of patients with diabetes regarding regular fundus examinations does not lead to action.

Of the 158 patients who had fundus examinations, only 12 (7.6%) had eye check up after being reminded by their doctors; this finding is similar to those of Huang *et al*^[21]. Among the various reasons for delayed examinations to treat DR, most patients with diabetes did not have eye examinations because they were not informed. Thus, the lack of communication between the patients and doctors as well as unclear explanations of the disease and treatment were ignored.

The logistic regression analysis suggested that younger patients with more education, lower medical insurance reimbursement rates, longer diabetes durations, more frequent exercise and more severe DR stages had higher DR awareness scores; furthermore, those with diet control scored higher than those without diet control.

Younger participants with more education exhibited better awareness and a stronger ability to understand DR-related knowledge. In addition, participants with lower medical insurance reimbursement rates were more likely to attend to healthcare and disease prevention programs to reduce expenditures due to health problems. Participants with longer diabetes durations exhibited a strong awareness of DR because they had more opportunities to receive education regarding the prevention and treatment of diabetes and its complications. Participants who exercised more frequently and used diet control had a higher awareness of DR because they had a better understanding of healthcare and were more willing to accept knowledge related to health and disease prevention. The multivariate regression analysis indicated that community-based health-related education should pay more attention to the elderly, those with lower education levels and especially those who were recently diagnosed with diabetes but do not have a strong awareness of healthcare.

According to the results from the current survey, a deeper and more focused education is needed to improve DR awareness. Importantly, a significant gap exists between having heard of DR and a real understanding of the disease. Constant community-based efforts are needed to transform the awareness of this disease into preventive actions. Because DR is an irreversible disease that causes blindness, it is important to improve patient awareness and compliance with regard to treatment and the subsequent follow-up evaluations.

REFERENCES

- 1 Thylefors B, Negrel AD, Pararajasegaram R, Dadzie KY. Global data on blindness. *Bull World Health Organ* 1995;73(1):115-121
- 2 Zheng Z. Clinical prevention and treatment of diabetic retinopathy: progress, challenges and prospects. *Chinese Journal of Ocular Fundus Diseases* 2012;28(3):209-213
- 3 Xie JT, Liu J, Zhou SP, Zhu SJ, Leng AW. Interpretation of 2009 American Diabetes Association guide to diagnosis and treatment of diabetes. *Chinese General Practice* 2009;12(14):1255-1257
- 4 Tong XW. Exploration of new models for prevention and treatment of diabetic retinopathy in local communities. *Shanghai Pharma* 2012;33(10):3-6
- 5 Huang XB, Zou HD, Wang N, Wang WW, Fu J, Shen BJ, Xie TH, Chen YH, XU X, Zhang X. Epidemiology study on the occurrence of diabetic retinopathy in residents at the age of ≥ 60 years in Beixinjing blocks of Shanghai. *Chinese Journal of Ocular Fundus Diseases* 2010;26(2):105-108
- 6 Bai XL, Zou HD, Ying XH, Wang WW, Zhu JF, FU J. Health economics evaluation of community-based blindness prevention project for diabetic eye diseases in Beixinjing Blocks of Shanghai City. *China*

Medical Herald 2011;8(24):109-111

7 Klein R, Sharrett AR, Klein BE, Moss SE, Folsom AR, Wong TY, Brancati FL, Hubbard LD, Couper D; ARIC Group. The association of atherosclerosis, vascular risk factors, and retinopathy in adults with diabetes: the atherosclerosis risk in communities study. *Ophthalmology* 2002;109(7):1225-1234

8 Kempen JH, O'Colmain BJ, Leske MC, Haffner SM, Klein R, Moss SE, Taylor HR, Hamman RF; Eye Diseases Prevalence Research Group. The prevalence of diabetic retinopathy among adults in the United States. *Arch Ophthalmol* 2004;122(4):552-563

9 Zou HD, Zhang X, Zhu JF, Wang FH, Xu X, Wang MM, Wu MF. Epidemiological investigation of diabetic retinopathy in Beixinjing Blocks of Shanghai. *Chinese Journal of Ocular Fundus Disease* 2006;22(1):31-33

10 Xu F, Zhu JF, Dong XW, Fu RJ, Shen B, Feng XF, Ji H, Fei K, Zhao HR. Clinical analysis of ocular complications in 338 patients with diabetes in a community of Shanghai. *Chinese Journal of Disease Control & Prevention* 2011;15(5):401-403

11 Qi DY, Fan HG, Lin K, Fu ZJ, Si M. Epidemiology survey on diabetic patients with retinopathy in Hongkou District of Shanghai. *Shanghai Journal of Preventive Medicine* 2012;24(5):247-248

12 Yuan MX, Xin Z, Feng JP, Wan G, Shi J, Gen K, Shi ZX, Zhu XR, Ma J, Yang JK. A population-based prevalence survey and risk factor analysis of diabetic retinopathy in Beijing Changping District. *Journal of Capital Medical University* 2012;33(5):669-675

13 Wang SL, Tong XW, He XG, Zhu JF, Zhao R, Zhao HJ. Characteristics of diabetic retinopathy prevalence and related factors in the population of 60 years and older. *Medical Information* 2012;25(2):

153-154

14 Yang Q, Fan LF, Zhang XQ. Study on the knowledge of ocular disease prevention and treatment among diabetic patients and effect of related education. *Chinese Journal of Practical Nursing* 2006;22(5):7-8

15 Xu J, Geng Y, Xue LL. Survey and analysis of knowledge on prevention and treatment of diabetic retinopathy. *Acta Academiae Medicinae Qingdao Universitatis* 2009;45(5):483-484

16 Livingston PM, Wood CA, McCarty CA, Harper CA, Keeffe JE, Taylor HR. Awareness of diabetic retinopathy among people who attended a diabetic retinopathy screening program. *Med J Aust* 1998;169(2):117

17 Merz CN, Buse JB, Tuncer D, Twillman GB. Physician attitudes and practices and patient awareness of the cardiovascular complications of diabetes. *J Am Coll Cardiol* 2002;40(10):1877-1881

18 Dandona R, Dandona L, John RK, McCarty CA, Rao GN. Awareness of eye diseases in an urban population in southern India. *Bull World Health Organ* 2001;79(2):96-102

19 Tajunisah I, Wong P, Tan L, Rokiah P, Reddy S. Awareness of eye complications and prevalence of retinopathy in the first visit to eye clinic among type 2 diabetic patients. *Int J Ophthalmol* 2011;4(5):519-524

20 Lewis K, Patel D, Yorston D, Charteris D. A qualitative study in the United Kingdom of factors influencing attendance by patients with diabetes at ophthalmic outpatient clinics. *Ophthalmic Epidemiol* 2007;14(6):375-380

21 Huang OS, Tay WT, Tai ES, Wang JJ, Saw SM, Jeganathan VS, Sandar M, Wong TY. Lack of awareness amongst community patients with diabetes and diabetic retinopathy: the Singapore Malay eye study. *Ann Acad Med Singapore* 2009;38(12):1048-1055