

# Effectiveness of diabetes eye health education during retinal screening

Jan Heggie

## ARTICLE POINTS

**1** Good glycaemic control is essential for preventing or delaying the progression of diabetic retinopathy.

**2** A questionnaire highlighted a lack of knowledge of normal blood glucose levels, although patients' perceived understanding of diabetes was high.

**3** A consistent knowledge weakness was seen in the over-64 age group.

**4** One-to-one verbal health education was beneficial in increasing knowledge of diabetic eye health during retinopathy screening.

**5** A structured, standardised educational strategy would ensure clearly communicated educational messages.

## KEY WORDS

- Diabetic retinopathy
- Retinal screening
- Eye health
- Glycaemic control
- Health education

Jan Heggie is Service Coordinator and Senior Diabetic Retinal Screener, Gloucestershire Diabetic Eye Screening Service, Cheltenham General Hospital, Gloucestershire.

## Introduction

**Diabetic retinopathy can be delayed or prevented by linking diabetic eye health with the importance of maintaining good glycaemic control. A multiple-choice questionnaire completed by 105 patients with diabetes, aged over 16 years, while attending a digital photographic eye-screening programme, showed a lack of patient knowledge of general diabetes, and particularly of diabetic retinopathy. After screening and education, correct answers to the questionnaire increased from 17% to 22%. Health education and viewing retinal images were thus identified as useful in changing patients' attitudes towards diabetes.**

**D**iabetic retinopathy is a microvascular complication of diabetes that affects the small blood vessels of the retina. There are several stages of retinopathy that can result in the formation of microaneurysms, haemorrhages and exudate; and, in the proliferative stage, new vessels, vitreous haemorrhage and retinal detachment may occur. Diabetic retinopathy is the most common cause of blindness among people of working age (Infeld and O'Shea, 1998). More than 10% of people with diabetes are reported to have impaired vision as a result of their condition (Klein, 1996).

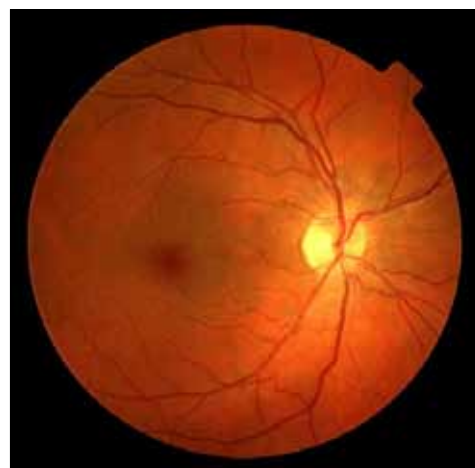
Good glycaemic control is essential for preventing or delaying the progression of retinopathy (Diabetes Control and Complications Trial Research Group, 1995; UK Prospective Diabetes Study (UKPDS) Group, 1999). One way of achieving this is to provide health education at the time of retinopathy screening, and to link diabetic eye health with the importance of maintaining good glycaemic control to reduce the risks of microvascular complications in the eyes.

Retinal images are captured by a digital fundus camera (*Figure 1*), which provides an instant visual display for the patient. It also presents the opportunity for education about diabetes eye health and helps to reinforce the severity of diabetic retinopathy and patients' susceptibility to it.

## Project aims

Gloucestershire Diabetic Eye Screening Service is a county-wide, community-based programme that offers 14 000 patients with diabetes screening in their own general practice, from a population of 461 936 (3%). The aim of the project was to determine the effectiveness of health education on patients' knowledge of diabetes and of diabetic eye health.

Patients with type 1 and 2 diabetes aged over 16 years completed a structured, self-administered questionnaire (pre-test) while attending a digital photographic eye-screening programme within general practice. This identified patients' knowledge of diabetes and diabetic eye health before screening, and before patient



*Figure 1. Digital retinal image. This provides a visual aid for diabetic eye health education.*

education about diabetic eye health. The level of change in knowledge as a result of the health education received was determined by a postal questionnaire sent 4 weeks later (post-test).

### Population and method

A convenience sample of 50 patients new to the screening programme, and 55 patients being screened for the second time, was selected. Patients were all registered with one general practice, and were seen during January 2001. The same registered nurse screened the selected sample using a standardised protocol for health education intervention.

### Health education intervention

Exposure of the sample group to the teaching intervention would determine any change in patients' knowledge. For the purposes of the study, the terms 'knowledge' and 'knowledge levels' refer to patients' ability to recall information about specific diabetes-related health issues.

The verbal health education intervention took approximately 5 minutes and included specific information relating to diabetic eye health, which was adapted to individual learning ability. It was delivered on a one-to-one basis using the educational approach and behaviour change model.

The study process did not measure the outcome of any behaviour change, so it was not possible to determine any change in lifestyle as a result of such intervention.

Data were analysed using the Statistical Package for the Social Sciences (1989–99), version 10 for Windows.

### Sample variables

The sample comprised 58 (55.2%) men and 47 (44.8%) women. Patients' age (Table 1), diabetes control (Table 2), duration of diabetes (Table 3) and age at diagnosis (Table 4) were identified in the pre-test questionnaire. Patients were also questioned on their perceived type of diabetes and the start time of any insulin.

### Pre-test results

#### Classification of diabetes

Fifty per cent of patients with diabetes, whether controlled by diet alone, tablets

or insulin, did not know their type of diabetes. Seven patients selected the wrong option when compared with their selected method of control.

#### What is the normal range of blood glucose?

Nearly half the patients (45.7%) were unaware that the normal blood glucose range was 4–8 mmol/l. Twice as many patients (75.6%) answered correctly in the  $\pm 64$  years age group, whereas 50% of those aged  $\leq 65$  years did not know the answer.

A higher percentage of patients not on insulin answered correctly, with more patients on insulin selecting the '7–15 mmol/l' option. Of those patients controlled on tablets or diet alone, 39.5% selected the 'don't know' option, whereas 15.8% of patients controlled on insulin did not know the answer.

No patient selected the '2–10 mmol/l' option, which may indicate that patients are aware that blood glucose levels should not drop below 4 mmol/l.

#### What is an HbA<sub>1c</sub> blood test?

Generally, patients' knowledge of an HbA<sub>1c</sub> blood test was low, with 63% selecting the 'don't know' option. Patients who were female, and those controlled on tablets

**Table 1. Age group demographics of the study sample**

Age (years)	Frequency	%	Valid %	Cumulative %
16–24	1	1.0	1.0	1.0
25–34	1	1.0	1.0	1.9
35–44	5	4.8	4.8	6.7
45–54	16	15.2	15.2	21.9
55–64	22	21.0	21.0	42.9
65–74	38	36.2	36.2	79.0
75–84	19	18.1	18.1	97.1
85+	3	2.9	2.9	100.0
<i>Total</i>	<i>105</i>	<i>100.0</i>	<i>100.0</i>	

**Table 2. Type of diabetes control within the study sample**

Type of control	Frequency	%	Valid %	Cumulative %
Diet	31	29.5	29.5	29.5
Tablets	55	52.4	52.4	81.9
Insulin	16	15.2	15.2	97.1
Insulin and tablets	3	2.9	2.9	100.0
<i>Total</i>	<i>105</i>	<i>100.0</i>	<i>100.0</i>	

or diet alone, were more likely to answer incorrectly or to not know the answer. Twice as many patients in the  $\pm 64$  years age group (44.4%) answered correctly, with 75% of those aged  $\leq 65$  years selecting the 'don't know' option.

**What is the correct blood pressure level?**

A blood pressure of 140/80 mmHg was identified as the normal blood pressure range (UKPDS Group, 1998). Less than half of respondents (42.9%) were aware of the correct level of blood pressure, and 41% did not know the answer. Fifty-six per cent of patients aged  $\pm 64$  years answered correctly, whereas 54% of those aged  $\leq 65$  years did not know the answer. Patients receiving antihypertensive treatment were not identified in the study.

**What is a cholesterol blood test?**

Eighty-one per cent of patients demonstrated knowledge of the reason for

taking a cholesterol blood test. Extraneous factors targeted at the general public, such as exposure to media advertising on the importance of cholesterol control, might have resulted in higher knowledge levels in this area.

**Which complication is not usually associated with diabetes?**

Patients were asked to determine which complication is not usually associated with diabetes. Question choices included changes in vision, kidney or lung, feet problems and heart disease.

Sixty-nine per cent of patients correctly identified changes in the lung as a complication not usually associated with diabetes. Twelve patients chose multiple answers.

Twenty-five per cent more patients answered correctly in the group controlled with insulin, compared with those controlled with diet or tablets. In the age group  $\pm 64$  years, 28% more patients answered the question correctly compared with those aged  $\leq 65$  years.

Changes in the kidney or vision were options that were not selected. Awareness of the potential complications to eyes, feet and kidneys may be increased because of routine, practical diabetes checks. Potential bias may have resulted from collecting data during an eye screening appointment. However, in the study by Dunning and Martin (1998), 58% of patients with type 2 diabetes selected eye disease as a complication of diabetes – the most popular response.

Six per cent of patients selected heart disease as a complication. Despite good knowledge of a cholesterol blood test, some patients may not link this with heart disease prevention.

**Knowledge of diabetic eye health**

Patient knowledge was weak in the area of diabetic eye health. Nineteen per cent of patients stated they did not know that diabetic retinopathy related to changes in the blood vessels at the back of the eye; 18% selected either blurred vision or raised pressure in the eye as a result of diabetic retinopathy, or gave multiple answers.

**Table 3. Duration of diabetes within the study sample**

Age (years)	Frequency	%	Valid %	Cumulative %
0	4	3.8	3.8	3.8
1	11	10.5	10.6	14.4
2	11	10.5	10.6	25.0
3	21	20.0	20.2	45.2
4	5	4.8	4.8	50.0
5-9	20	19.0	19.2	69.2
10-14	12	11.4	11.5	80.8
15-19	8	7.6	7.7	88.5
20-24	5	4.8	4.8	93.3
25-29	3	2.9	2.9	96.2
30+	4	3.8	3.8	100.0
Total	104	99.0	100.0	
Missing answer	1	1.0		
Total	105	100.0		

**Table 4. Age at diagnosis of diabetes within the study sample**

Age (years)	Frequency	%	Valid %	Cumulative %
0-19	5	4.8	4.8	4.8
20-39	3	2.9	2.9	7.6
40-49	23	21.9	21.9	29.5
50-59	23	21.9	21.9	51.4
60-69	33	31.4	31.4	82.9
70-79	15	14.3	14.3	97.1
80+	3	2.9	2.9	100.0
Total	105	100.0	100.0	

Twenty-nine per cent of patients did not know that diabetic retinopathy can be associated with unstable diabetes control, while 8% chose a family history of the condition, long exposure to sunlight or multiple answers.

Sixty-four per cent of patients correctly identified the recommended frequency of dilated eye examinations for diabetic retinopathy as every 12 months or more frequently; 8% selected every 18 months; 17% selected every 2 years; and 11% did not know.

Fifty-four patients (51.4%) correctly identified that diabetic retinopathy has no symptoms until the condition is serious; 38 patients (36.2%) did not know the answer; and 12.4% chose either 'I would have bloodshot eyes' or 'I would have eye pain'.

The knowledge weaknesses highlighted here may reflect the possible lack of information available to patients regarding complications of diabetes and the effects experienced. Some general written literature focuses on the importance of living with diabetes rather than on raising awareness of the complications that may result from poor management of the condition.

### Health education

Patients routinely received an information leaflet written by the Diabetic Eye Screening Service with the screening invitation, which addressed commonly asked questions on diabetic retinopathy and what to expect at the screening appointment. This meant that patients had already received some eye health education before the pre-test questionnaire.

However, patients may not understand, read or be able to recall the information when questioned. In relation to a health education leaflet for breast screening, Boer and Seydel (1995) stated that the leaflet increased knowledge levels on breast cancer and mammography screening, but did not influence patients' perceived seriousness of breast cancer.

Health education in the form of a leaflet may be useful for increasing knowledge about certain conditions, but not necessarily for changing knowledge about their effects and complications.

### Patients' perceived level of understanding diabetes

Patients' perceived levels of understanding diabetes were mixed, but overall patients felt they had a lot or enough understanding of routine issues. However, respondents appeared to have little understanding of 'Medic Alert', Diabetes UK, or what to expect when experiencing low 'blood sugar' levels.

### Patients' confidence in understanding diabetes

Patients' confidence in understanding their diabetes was questioned on a scale of 6 (very confident) to 0 (not at all confident). Confidence level 4 was chosen by 40 patients (38.1%), which represented the most frequently selected level. Three per cent of patients scored their confidence level at 1, and 18% selected the highest confidence score of 6.

Male patients perceived a greater confidence, with 43% scoring 5 or 6, compared with 34% of females. Thirteen per cent of women perceived low confidence, scoring 1 or 2, whereas only 3.4% of men scored the same. The confidence score of 3 and 4 was selected by an equal number of men and women.

Men overall had slightly higher knowledge levels of diabetes. Male patients perceived a greater level of confidence in diabetes knowledge, which could be a reflection on men assessing their health more positively (Bennett and Murphy, 1998) and thus translating this into a feeling of confidence.

There was little relationship between knowledge and duration of diabetes, although people who had had diabetes for more than 5 years generally had an increased knowledge. Owing to the constraints of a small study, the number of years since diagnosis were divided into 0-4 and 5+; valuable data may therefore have been missed by comparing only these two groups.

Generally, patients being screened for the second time were more knowledgeable about general diabetes and eye health, although it cannot be assumed that the episode of screening was responsible for the difference in knowledge base.

### PAGE POINTS

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**2** Patients' perceived levels of understanding diabetes were mixed, but overall patients felt they had a lot or enough understanding of routine issues.

**3** There was little relationship between knowledge and duration of diabetes, although people who had had diabetes for more than 5 years generally had an increased knowledge.

**4** Patients being screened for the second time were generally more knowledgeable about general diabetes and eye health.

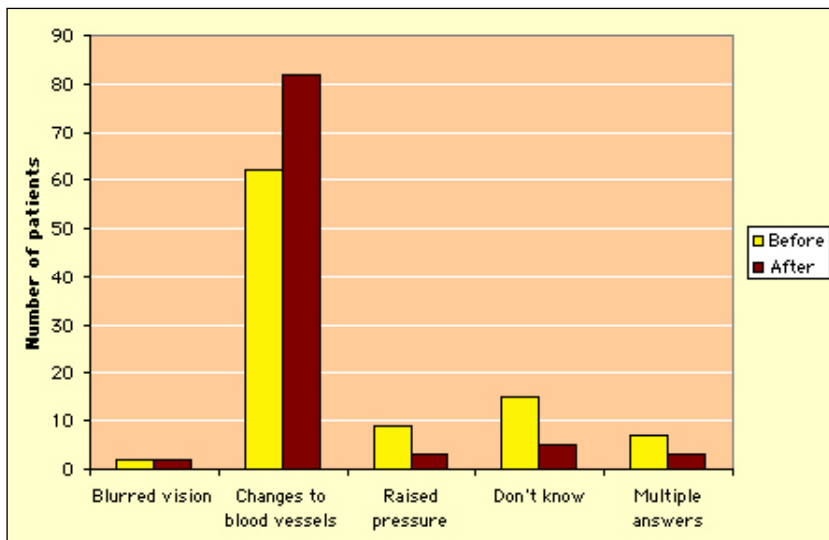


Figure 2. Patients' knowledge of what is diabetic retinopathy. Options selected before and after the health education intervention.

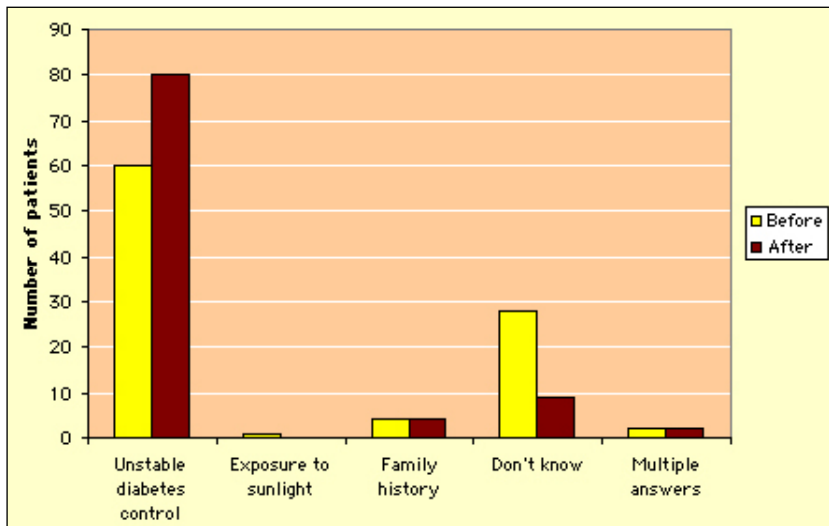


Figure 3. Patients' knowledge of the cause of diabetic retinopathy. Options selected before and after the health education intervention.

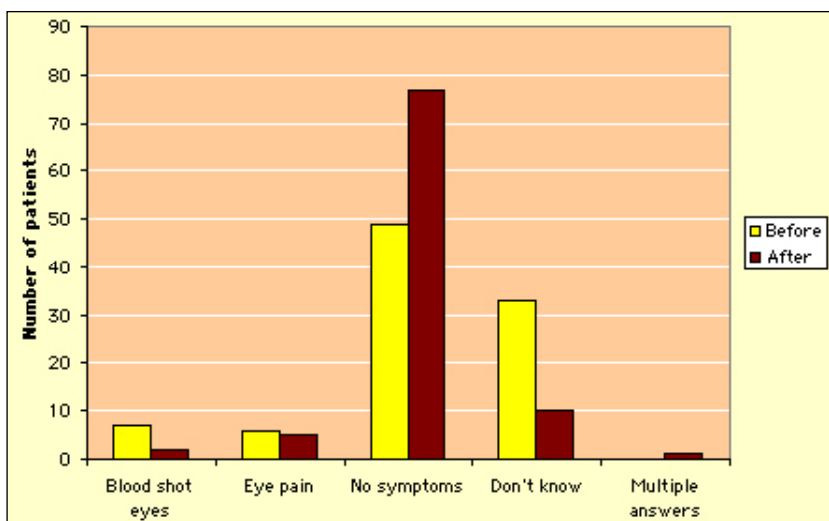


Figure 4. Patients' knowledge of the symptoms associated with diabetic retinopathy. Options selected before and after the health education intervention.

### Post-test results

The post-test questionnaire produced a 90.5% response. Figures 2, 3, 4 and 5 show a comparison of patients' diabetic eye health knowledge base before screening, and one month after the health education intervention at the photographic eye-screening appointment.

There was an increase in the percentage of patients selecting the correct answer post-test, compared with responses to the same questions pre-test. Correct responses to the question on what is diabetic retinopathy increased by 23.4%. There was a 20.4% increase in correct answers to the question on the cause of retinopathy, and a 29.7% increase in correct answers on the effects of diabetic retinopathy.

The question on the recommended frequency of dilated eye examinations showed only a 4.6% increase in correct answers. Patients are encouraged to have annual eye examinations, but are advised that their next photographic screening would be in 2 years time; this may have been confusing for patients.

### Evaluation of the health education intervention

The immediate results indicate that the health education process was successful in increasing patients' knowledge levels of diabetic eye health. However, increased knowledge may not necessarily be related to the educational intervention.

Participation in the pre-test questionnaire may have highlighted areas of patient knowledge weakness, thereby encouraging patients to listen more actively to the health education provided. This 'Hawthorne effect' (Wickstrom and Bendix, 2000) may introduce bias to the findings, in that if these patients were not under observation they might not have shown similar improvements in knowledge.

Educational influences from such variables as television, radio, the internet and visits to the diabetes clinic, which could affect knowledge levels between the two tests and therefore the relationship between the pre- and post-test results, may also be significant.

There was no measure of the nurse's

ability to educate, preventing generalisation of the results.

Forty-six per cent of patients found the health information given at the time of screening very useful, scoring 6, with 12% scoring 3 and 4.

Fifty-four per cent of patients identified seeing the digital photograph of the back of the eye as very useful, scoring a maximum of 6.

Twenty-nine per cent of patients scored 6 when asked if the digital image had changed their attitude to diabetes, whereas 10% responded to the option of no change in attitude at all.

### Conclusion

The study findings highlight the lack of patient awareness of some basic diabetes issues. Particularly worrying was the lack of knowledge of normal blood glucose levels and diabetic eye health.

Patients' perceived level of understanding diabetes was high, with their confidence in understanding diabetes above average, whereas actual knowledge and understanding levels were low. However, there was a positive outcome of the health education intervention.

Although the type and content of the health education that patients had received before the study was not identified, it could be suggested that a structured, standardised, educational strategy, whether in hospital-based clinics or in primary care, would ensure that educational messages were clearly communicated.

A consistent knowledge weakness was seen in the over-64 age group, which represents the largest proportion of people with diabetes. Providing additional written information on topics discussed may be beneficial, as the number of patients who read written information when it is provided in the context of a medical appointment is generally high (Ley, 1988).

A positive outcome of increased patient knowledge would be improved metabolic control and a reduced incidence of complications. Identification of any short-term or sustained behavioural change following patient education would therefore be beneficial. ■

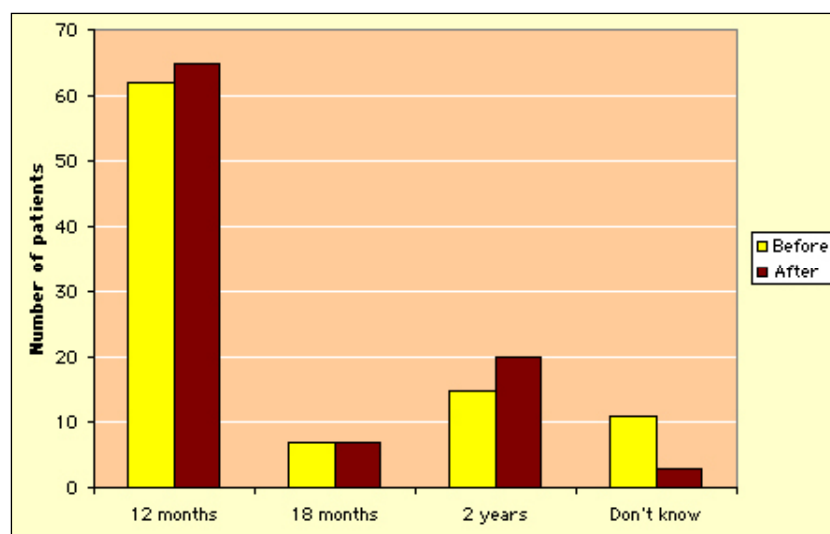


Figure 5. Patients' knowledge of the recommended frequency of dilated eye examination for diabetic retinopathy. Options selected before and after the health education intervention.

Research was completed as part of the author's Master of Science in Health Promotion at Bath Spa University College.

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