AN EDUCATIONAL INTERVENTION TO IMPROVE THE QUALITY OF CARE OF DIABETIC PATIENTS

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Objective. As few studies have addressed intervention for in-hospital care of diabetes mellitus (DM) patients, we set out to investigate whether an educational intervention targeting doctors could improve the quality of care for diabetic patients.

Design. An observational interventional study conducted at Pretoria Academic Hospital, a tertiary care hospital.

Subjects. Doctors working in the Department of Internal Medicine were the subjects of two interventional sessions on diabetic care, and all diabetic patients admitted to the wards in the above Department were evaluated.

Outcome measures. A Diabetes Attitude Scale (DAS-3) and a Diabetes Practice Scale (DPS) were completed by each doctor before and after the interventional educational sessions. Data from diabetic patients in the wards were collected for 5 weeks before and 5 weeks after the interventional training, and these two sets of data were compared to measure the effect of the interventional training.

Results. Subscales of the DAS-3 showed an improvement, with a statistically significant improvement in attitude regarding seriousness of DM ($P = 0.03$), and a trend towards improvement in attitude regarding need for special training and patient autonomy. Most of the items on the DPS improved significantly ($P < 0.05$).

Conclusions. A short educational intervention resulted in an improvement in attitude, knowledge and clinical management of diabetic patients.

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The prevalence of diabetes is increasing and it is estimated that more than 220 million people worldwide will have diabetes by the year 2010.[1] Diabetes is one of the chronic diseases in which self-management plays an important role in the treatment of the disease. For patients to understand their disease and its management fully, education by the doctor or health care provider is essential. The better-educated patient will have higher levels of participation in diabetes self-care and also lower levels of glycated haemoglobin, suggesting better glycaemic control.[2] Educational programmes aim to increase awareness of the seriousness of diabetes, risk factors for diabetes and strategies to prevent diabetes and its complications, and also aim to improve understanding of diabetes and its control and to promote an integrated approach to care.[3]

Previous studies[4] have shown that an inappropriate attitude on the part of a health care provider can influence the treatment of a patient negatively. In 1975, the National Diabetes Commission's report to the United States Congress[4] raised several issues concerning health providers' attitudes towards diabetes mellitus (DM). This report suggested that attitudes were often inappropriate. The commission recommended the development of an attitude scale and proposed that attitudes should be assessed before and after intervention activities.[4] During the 1990s, there was considerable interest in assessing the quality of health care for diabetic outpatients in South Africa.[5-8] Some of the major findings were: poor patient glycaemic and blood pressure (BP) control,[5] a high prevalence of diabetic complications,[5] inadequate examination for treatable complications,[6] discrepancies between recommended care and practice,[7] staff/patient communication barriers,[7] and lack of comprehensive patient care.[8] These findings suggest that the quality of diabetes care in South Africa may be poor. However, none of the studies used a model to assess quality of care, nor did they use a standardised attitude scale.

No studies in South Africa have evaluated in-hospital care of DM patients or developed an intervention for improving the quality of health care, yet the hospital setting provides an ideal opportunity for re-evaluating blood glucose and BP control, screening for diabetic complications, patient education and in-hospital training of patients by health care providers on self-management of their disease.

The overall aim of this study was, therefore, to investigate whether an educational intervention targeting doctors could change their attitudes towards diabetic patients and influence their practice of diabetic care.

METHODS

This observational, intervention-evaluation study was conducted in the Pretoria Academic Hospital, South Africa. The study was divided chronologically into three parts.

The first phase comprised prospective follow-up of hospitalised patients with diabetes in the Department of Internal Medicine. A patient questionnaire was designed to ascertain the demography of diabetes and health-related quality of life, as well as education received while the patients were in the hospital. This part of the study was conducted with the assistance of a trained, multilingual interviewer fluent in several indigenous languages. We also evaluated the in-hospital work-up of the hospitalised patients regarding glucose control, BP control, screening for diabetic complications, co-morbidity[9] and treatment. The co-morbidity index was used to ensure that the two groups of patients assessed before and after the intervention were similar.

The second part of the study consisted of two educational intervention sessions. These sessions were held on two Thursday afternoons over two consecutive weeks, each session lasting an hour and a half. At the beginning of the first session the attending doctors completed a Diabetes Attitude Scale[10] (DAS-3) and a Diabetes Practice Scale (DPS). The DAS-3 consists of 33 items in five subscales and measures the following: need for special training, seriousness of type 2 diabetes, value of tight control, psychosocial impact of diabetes, and patient autonomy. Reliability coefficients of the DAS-3 ranged between 0.65 (psychosocial impact) and 0.80 (seriousness).[10] The DPS was designed for consultants, registrars and medical officers and consists of four open questions and seven treatment-related statements. The four open questions were: complication screening, contraindications for 24-hour urine albumin assessment, optimal metabolic control in a diabetic patient and fundoscopy outcomes and the need for referral to an ophthalmologist. Reference values for optimal metabolic control of diabetic patients were taken from the American Diabetes Association (ADA)'s clinical practice recommendations 2000.[11] The registrars use the ADA's clinical practice recommendations[11] as part of their training programme, and as this is a more recent publication than the 1997 South African guidelines[12] it was used as a reference. The seven treatment-related statements were on treatment of diabetic patients. The original seventh treatment-related question referred to use of insulin-sensitising oral agents and sulfonylureas or insulin as combination therapy, but since insulin-sensitising oral agents were not available in South Africa at the time of the study, this question was changed to whether combination therapy involving repaglinide and sulfonylureas was acceptable. Responses to the seven treatment-related statements were based on a five-point Likert scale ranging from one to five (strongly disagree to strongly agree).[13]

After completion of the questionnaires, descriptive statistics acquired during the first 5 weeks were discussed. Thereafter an interactive session was held during which the doctors could perform fundoscopies on 3 diabetic subjects. With the aid of a slit lamp and video screens, an ophthalmologist also evaluated these patients while giving a description of lesions and their management. The specialist and attendants also discussed the criteria for referring patients with different fundoscopy outcomes to an ophthalmologist.

The second intervention session consisted of a discussion on the screening and diagnosis of diabetes, metabolic goals and new trends in diabetes management. This was followed by a lecture on the complications of diabetes (nephropathy, vasculopathy, neuropathy and the diabetic foot). Thereafter a diabetic educator highlighted important aspects of patient education such as diet and the pathophysiology of diabetes. Finally the attendants completed the DAS-3 and DPS for the second time in order to determine the impact of the education.

The third part of the study involved another 5 weeks of prospective hospitalised diabetic patient follow-up. The data collected from this group of patients were used to ascertain the effects of the educational intervention.

Statistical analysis

Data were analysed using Statistica software. Descriptive statistics were used to describe patient baseline characteristics and patient evaluation, both before and after intervention. To compare the continuous variables Student's *t*-test or the Mann-Whitney *U*-test was used, depending on distribution of the data. Proportions at baseline and pre- and post-intervention evaluation were compared with Fisher's exact test. Paired pre- and post-intervention DPS and DAS scores for doctors attending both intervention sessions were compared with the Wilcoxon signed rank test.

Results

A total of 14 doctors worked in the Department of Internal Medicine during the first 5 weeks of follow-up (12 registrars and 2 medical officers). Fifteen doctors worked in the wards during the second 5 weeks of follow-up (13 registrars and 2 medical officers), with 8 present at both interventions, of whom 3 attended both interventions and worked in the wards during both phases 1 and 2. Twenty-three doctors attended both the first and the second interventions, and only their data were analysed. There were 33 doctors at the first educational session and 31 at the second intervention. This included doctors who were not working in the wards but in subspecialty departments.

The results of the DAS-3 are shown in Table I. Pre- and post-intervention DAS-3 scales were compared for those attending both sessions only ($N = 23$). All five subscales showed an improvement. Statistical analysis pointed to significant differences in attitude regarding seriousness of DM ($P = 0.03$), while the DAS-3 score of need for special training and patient autonomy indicated a borderline significant improvement ($P = 0.07$). As shown in Table II, the doctors' scores decreased for

Table I. Results of the Diabetes Attitude Scale (DAS-3)*

Questions	Pre-intervention (N = 23 doctors) (median (quartiles))	Post-intervention (N = 23 doctors) (median (quartiles))	P-value
Need for special training	4.2 (4.2, 4.8)	4.6 (4.2, 5.0)	0.07
Seriousness of DM	4.0 (3.9, 4.6)	4.6 (4.0, 4.9)	0.03
Value of tight control	4.3 (3.9, 4.4)	4.4 (4.1, 4.7)	0.45
Psychosocial impact of DM	4.0 (3.8, 4.5)	4.0 (3.8, 4.5)	0.22
Patient autonomy	3.6 (3.5, 3.9)	3.8 (3.5, 4.3)	0.07

* Scale from 1 - 5 with 5 as the best score.
DM = diabetes mellitus.

Table II. Results of Diabetes Practice Scale (DPS)

Questions	Pre-intervention (N = 23 doctors) (mean (SD))	Post-intervention (N = 23 doctors) (mean (SD))	Change (mean (SD))	P-value
Complication screening (10)*	5.80 (1.27)	5.80 (1.48)	0.00 (1.96)	0.88
Contraindications for 24-hour urine albumin sample (6)	0.52 (0.90)	1.70 (1.11)	1.17 (1.07)	< 0.01
Optimal metabolic control in a diabetic patient (9)	3.83 (1.99)	5.04 (1.50)	1.21 (2.11)	0.01
Fundoscopy outcomes and need for referral (11)	4.57 (1.41)	5.22 (1.00)	0.65 (1.03)	0.01
Effectiveness of oral agents†	2.17 (1.07)	2.00 (0.67)	0.17 (0.83)	0.27
Progression of disease‡	3.22 (1.24)	3.96 (0.88)	0.74 (1.42)	0.03
Importance of glycaemic control†	1.96 (1.22)	2.04 (1.55)	0.09 (1.53)	0.78
Importance of insulin resistance†	1.23 (0.43)	1.41 (0.73)	0.18 (0.59)	0.18
Glycaemic control and advancing age†	1.65 (0.78)	1.48 (0.51)	0.17 (0.72)	0.25
Avoidance of progression of type 2 diabetes†	2.04 (0.93)	2.78 (1.31)	0.74 (1.51)	0.04
Combination therapy with repaglinide*	3.45 (0.80)	3.86 (0.71)	0.41 (0.80)	
	0.04			

*Figures in parentheses are maximum points for the question.
† Scale from 1 - 5 with 1 as the best score.
‡ Scale from 1 - 5 with 5 as the best score.
SD = standard deviation.

complication screening, importance of glycaemic control and insulin resistance and combination therapy with repaglinide. Only the latter difference was statistically significant (P = 0.04). The other items of the DPS improved, of which four were statistically significant: contraindication for 24-hour urine albumin sample (P < 0.01), optimal metabolic control in a diabetic patient (P = 0.01), progression of disease (P = 0.04) and avoidance of progression of type 2 diabetes (P = 0.04).

Table III shows the upper limits of metabolic and BP values as given by doctors in response to the DPS question on optimal metabolic control in a diabetic patient. Answers regarding pre- and post-intervention values of low-density lipoprotein (LDL) cholesterol (P = 0.01), and systolic (P = 0.02) and diastolic BP (P = 0.01), changed significantly.

In the first 5 weeks of the follow-up (phase 1), 31 patients were included in the study, of whom 2 died. Four patients were excluded, and 1 refused to participate in the study. Permission was not obtainable from the parents or legal guardians of the 2 minors enrolled in the study. One patient was unable to answer questions.

In the second 5 weeks of the follow-up (phase 2), 32 patients were included in the study. Seven patients were excluded. Two patients refused participation, permission could not be obtained for 2 minors, and 3 patients were unable to answer questions. Table IV shows that the baseline characteristics of the study population did not differ significantly between phases 1 and 2.

Table III. Optimal metabolic and blood pressure control as reported by the doctors

	Pre-intervention (N = 23 doctors) (mean (SD))	Post-intervention (N = 23 doctors) (mean (SD))	Change (mean (SD))	P-value
HbA_{1c} (%)	6.98 (0.98)	6.95 (0.38)	0.03 (0.88)	0.83
Total cholesterol (mmol/l)	4.56 (0.50)	4.56 (0.59)	0.04 (0.62)	0.98
LDL cholesterol (mmol/l)	2.93 (0.62)	2.55 (0.55)	0.39 (0.84)	0.01
Fasting glucose (mmol/l)	6.53 (1.17)	6.52 (0.59)	0.01 (1.10)	0.80
Postprandial glucose (mmol/l)	9.97 (1.37)	9.29 (1.21)	0.68 (1.64)	0.08
Bedtime glucose (mmol/l)	8.41 (2.07)	8.81 (1.54)	0.40 (2.22)	0.45
Systolic blood pressure (mmHg)	123.8 (7.77)	128.4 (6.64)	4.57 (8.11)	0.02
Diastolic blood pressure (mmHg)	80.6 (4.35)	83.6 (3.42)	2.96 (4.75)	0.01

HbA_{1c} = haemoglobin A_{1c}; LDL = low-density lipoprotein; SD = standard deviation.

Table IV. Baseline characteristics of the study population

	Phase 1 (N = 31 patients)	Phase 2 (N = 32 patients)	P-value
Age (yrs) (mean (SD))	52 (18.6)	50 (16.7)	0.63
Charlson's co-morbidity index (median (range))	2.17 (1.23)	2.16 (1.27)	0.84
Male (N (%))	14 (45.2)	16 (50.0)	0.80
Type 2 diabetes (N (%))	19 (61.3)	18 (56.3)	0.80
Previous clinic attendance (N (%))			0.27
Diabetic outpatient clinic	10 (32.3)	6 (18.8)	
Other clinic/hospital	16 (51.6)	16 (50.0)	
None	5 (16.1)	10 (31.3)	
Reason for admission (N (%))			0.66
New or uncontrolled DM	16 (51.6)	20 (62.5)	
Complicated DM	7 (22.6)	5 (15.6)	
Coincidental DM	8 (25.8)	7 (21.9)	

SD = standard deviation; DM = diabetes mellitus.

Table V gives a description of the patient work-up. During the second 5 weeks the doctors performed significantly better with regard to foot-neuropathy assessments (P = 0.03) than during the first 5 weeks. Doctors also performed more fundoscopies or referred to an ophthalmologist more often (P = 0.04). Furthermore, there was a significant increase in therapeutic changes (P = 0.01) and the number of educated patients (P = 0.01).

Discussion

This study demonstrates that the knowledge and attitudes regarding diabetes, as measured using the DAS-3 and DPS, improved after the doctors attended the educational intervention. On the DAS-3 only the section on seriousness of type 2 diabetes showed a statistically significant change. The scores of need for special training and patient autonomy showed a non-significant trend towards improvement. The doctors scored lowest on the questions regarding patient autonomy. The upper limits of the metabolic and BP values in a diabetic patient, as given by the doctors, closely matched the reference values.[11] After the intervention the work-up of patients in the hospital improved in a number of ways. Notably, there was an increase in the number of foot-neuropathy assessments performed after the intervention. A possible reason for improvement in the neurological assessments could have been that during the educational intervention the doctors were instructed on how to use a monofilament and every doctor was given one. The number of foot vascular assessments remained low. Possible reasons for this could have been no practical demonstration on evaluation of the peripheral vascular status and underreporting (assessments could have been done, but were not recorded in the file). The latter is a distinct possibility as the patient file may mention 'normal cardiovascular examination' without referring specifically to peripheral pulses.

The initial aim of 60 patients in the study was achieved.

Table V. Work-up of study population

Variable	Phase 1 (N = 31)	Phase 2 (N = 32)	P-value
Mean glucose (mmol/l)* (mean (SD))	10.4 (3.4)	9.9 (3.0)	0.49
HbA_{1c} measured (N (%))	13 (41.9)	18 (56.3)	0.32
Urine albumin measured (N (%))	6 (19.4)	6 (18.8)	1.00
Fundoscopy done (N (%))	14 (45.2)	18 (56.3)	0.45
Foot-vascular assessment done (N (%))	3 (9.7)	3 (9.4)	1.00
Foot-neuropathy assessment done (N (%))	1 (3.2)	8 (25.0)	0.03
Therapy change (N (%))			0.01
Therapy not adjusted	15 (48.4)	6 (18.8)	
Therapy adjusted	14 (45.2)	25 (78.1)	
Patient education (N (%))			0.01
Not educated	15 (48.4)	6 (18.8)	
Educated	13 (41.9)	23 (71.9)	
Patient educated by (N (%))			0.07
Doctor	3 (9.7)	1 (3.1)	
Other†	7 (22.6)	14 (43.8)	
Both doctor and other	3 (9.7)	7 (21.9)	

* Mean glucose value over the 84 hours immediately before discharge.
†Dietician, nurse or student.

Although the sample was sufficient for our goals, a larger population sample would have been better. However, this number of diabetic patients evaluated accounts for 17% of the total annual number of diabetic patients hospitalised in this Department. This makes the sample significant and representative. Twenty-three doctors attended both the first and second interventions. The doctors during the first phase of the evaluation were not the same as those during the third phase of the evaluation, and not all the treating doctors attended the intervention sessions.

The ideal expectation was that the same doctors would be present at the first and second interventions and work in the same wards during phases 1 and 2. Unfortunately this was not the case, which may have diluted the effect of the intervention. However, the doctors would have been biased if they were informed that they had to stay in the same wards for evaluation of the intervention. Because the second DAS-3 and DPS were completed immediately after the second intervention, only the short-term effects of the intervention on attitude and knowledge could be measured. During the first 5 weeks of follow-up the doctors did not know the exact aim of the study, and therefore were not influenced in their patient work-up. After the intervention the doctors were aware of the control of their work-up, and it remains to be seen whether the improved work-up will continue after this study. There is a great diversity of languages in South Africa and a multilingual interpreter proved most helpful.

To the best of our knowledge, there have been few investigations of this nature, making it difficult to compare our results with those of other studies. An earlier study by Sharp and co-workers also used the DAS and the seven treatment-related statements we used in the DPS.[13] Because we used the latest version of the DAS (DAS-3) we cannot compare all the results with this earlier study. Only two subscales were similar in both versions. The change in attitude towards need for special training and patient autonomy in the other study[13] showed a statistically significant difference, but in our study both did not reach significance. Attitudes toward the seriousness of type 2 diabetes changed significantly in our study. The number of patients educated changed significantly because doctors were sensitised by the lecture given by the diabetic educator. If they did not undertake the education themselves they referred the patient to a dietician or sister to provide the patient with education on diabetes.

In conclusion, a short educational intervention resulted in some improvement in attitude, knowledge and patient work-up in the Pretoria Academic Hospital. Medical personnel benefited from intensified training on different aspects of diabetic patient care, resulting in better understanding of the disease, increased knowledge and changes in attitude towards diabetic patients. Further research is needed to evaluate the long-term effects of such an educational intervention. This study emphasises the need for outcome-based continuing medical education of medical personnel.

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ANALYSIS OF TWO MUTATIONS IN THE MTHFR GENE ASSOCIATED WITH MILD HYPERHOMOCYSTEINAEMIA — HETEROGENEOUS DISTRIBUTION IN THE SOUTH AFRICAN POPULATION

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Objective. The frequencies of mutations 677C→T and 1298A→C in the methylenetetrahydrofolate reductase (MTHFR) gene, previously shown to be associated with decreased enzyme activity that may lead to hyperhomocysteinaemia and consequently increased risk of cardiovascular disease (CVD), were determined in the South African population.

*Methods. Hinf*I (677C→T) and *Mbo*II (1298A→C) restriction enzyme analyses were performed on amplified DNA samples of 76 white, 73 coloured and 60 black subjects.

Results. The mutant alleles of mutations 677C→T and 1298A→C were more common in the white (allele frequencies 0.36 and 0.37, respectively) than in the black population (0.04 and 0.09), while intermediate frequencies were detected in the coloured population (0.18 and 0.30). Homozygosity for mutation 677C →T was not detected in the black cohort, while this genotype was detected in 1 coloured (1.4%) and 8 white (10.5%) subjects. In the black population, 5% of the 60 subjects analysed were homozygous for mutation 1298A→C, compared with approximately 12% in both the white and coloured populations.

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