Physician education programme improves quality of diabetes care

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Background. Diabetes mellitus is a common chronic disease needing long-term glycaemic control to prevent complications. Guidelines are available for achievement of optimal glycaemic control, but these are seldom properly instituted.

Objectives. To determine if a physician education programme and a structured consultation schedule would improve the quality of diabetes patient care in a diabetes clinic.

Setting. Two tertiary care diabetes clinics at Kalafong Hospital, Pretoria.

Study design. Quasi-experimental controlled before-and-after study.

Methods. A baseline audit of the quality of care in two comparable diabetes clinics was performed. Three hundred patients were randomly selected for audit of their hospital records: 141 from the intervention and 159 from the control clinics. Thereafter a physician training programme and a structured consultation schedule were introduced to the intervention clinic and maintained for a 1-year period. The control clinic continued with care as usual. Process and outcome measures were determined at a post-intervention audit and compared between the two groups. Consultation time was measured for both the intervention and control groups and data were compared.

Results. At baseline the intervention and control groups did not differ significantly with regard to process and outcome measures. After intervention the intervention group had significantly higher process measure scores than the control group ($p < 0.01$). HbA$_{1c}$ did not significantly differ between the two groups ($p = 0.60$). The average number of clinic visits reduced over time for the intervention group compared with the control group ($p < 0.01$), but the average consultation times were significantly longer ($p < 0.01$).

Conclusion. The introduction of a physician education programme and a structured consultation schedule improved the quality of care delivered at a tertiary care diabetes clinic.

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Globally diabetes mellitus is a significant problem with an estimated 140 million diseased individuals worldwide, expected to increase to 300 million by the year 2025.[1] South Africa is not spared from this chronic disease and has an estimated prevalence of between 5.3% and 8.0% among urbanised populations.[2-4]

According to the World Health Organisation (WHO) diabetes is the fourth largest underlying cause of death, and is strongly associated with cardiovascular disease.[1] Hypertension is a common co-morbidity for diabetes in South Africa, and contributes significantly to morbidity related to diabetes.[5-7]

It is therefore very important to optimise the care of diabetic patients at primary secondary and tertiary care level. Numerous clinical practice guidelines for management of diabetes have been compiled and circulated to health care workers, but despite this the level of diabetes care is still not ideal because of suboptimal implementation strategies. Guideline implementation problems are a significant problem in South Africa, as described in the study by Levitt *et al.*[8] who studied and attempted to improve the quality of diabetes care in primary care clinics in Cape Town. However this is not only a local problem, as evidenced by numerous international studies indicating suboptimal and varied implementation of guidelines.[9]

This study attempts to describe and test a model to improve the quality of diabetes care in a tertiary care diabetes clinic. The model includes a physician training programme and a structured consultation schedule based on the South African guidelines for diabetes care.[10]

Methods

Approval for conducting this study was obtained from the Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria. Informed consent was obtained from all patients and doctors taking part in this study.

This study had a quasi-experimental controlled before-and-after design, comparing two clinics at the same tertiary care institution (Kalafong Hospital).

Both clinics were initially audited cross-sectionally to acquire baseline data on quality of patient care. The average

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consultation time was measured at the same time at baseline. An intervention, which included a structured consultation schedule and a physician education programme, was introduced in one of the clinics. The other clinic functioned as the control against which the efficacy of the intervention was measured. A second audit, at the end of the 1-year intervention period, was done to determine the efficacy of the intervention. Patients attending and doctors working in either of the clinics were not allowed to cross over to the other clinic. Both clinics utilised the same nursing staff and the same premises. The medical staff for the two clinics consisted of a specialist physician, a senior registrar and two medical officers each.

Structured consultation schedule and physician training programme

Both the training programme and the structured patient care schedule were based on the Society for Endocrinology, Metabolism and Diabetes of South Africa (SEMDSA) guidelines for the management of type 2 diabetes (the most recent South African guidelines available at the time of this study).[10] All procedures and special investigations were planned for this study according to these clinical practice guidelines.

An interactive training programme was introduced for all doctors working in the intervention diabetes clinic. This consisted of quarterly non-compulsory training sessions. These sessions included theoretical knowledge transfer as well as discussion of practical aspects of outpatient diabetes care. Topics included glycaemic control in type 1 and type 2 diabetes, prevention and diagnosis of diabetic foot problems, diagnosis and prevention of diabetic eye problems, risk reduction of macrovascular disease in diabetic patients, micro-albuminuria, and educating the diabetic patient on diabetes care. A training session was held before each section of the structured consultation schedule and specifically addressed issues related to that section.

In the intervention clinic, diabetes care was changed from the previous independent approach (where each doctor saw patients without constraints, and decided on examinations and special investigations alone), to a structured approach. This was accompanied by a standardised easy-to-complete clinical record form. The structured approach aimed to make the care more homogeneous. Each patient was scheduled to attend the clinic quarterly, with a different focus at each visit. The first quarterly visit focused on foot care with a proper foot examination and patient education on foot care. An HbA_{1c} test was also done at this visit. During the second quarterly visit patients received education on their medication and the importance of regular use thereof. Each patient was also referred to the dietician, their body mass index was calculated, and advice was given with regard to obesity and cardiovascular risk factors. Each patient had a urine test for micro-albuminuria, a lipid profile, a serum creatinine and an HbA_{1c} test during the third quarterly visit. The fourth

quarterly visit focused on eye problems. Visual acuity was measured and direct fundoscopy done for each patient, or the patient was referred to an ophthalmologist. An ECG was also done during the fourth visit.

Audit of patient records

Consent for auditing of clinical records was obtained from 300 randomly selected patients, 141 from the intervention and 159 from the control clinics. Patients were numbered according to arrival at the clinic. Random numbers were obtained from a random number website, and patients corresponding to the random numbers were approached for inclusion in the study audits. An independent person with a thorough knowledge of diabetes audited all hospital records at baseline and 1 year later.

The patient records were assessed for evidence of the following process measures, which ought to have been done according to the SEMDSA guidelines: a foot examination, an eye examination, a urine test for micro-albuminuria, dietary counselling, an HbA_{1c} test, and a lipid profile during the 12 months preceding each audit. A score was calculated from these six process measures (each process measure counting one point) for each patient at the baseline and post-intervention audits. The main outcome measure was the HbA_{1c} value. HbA_{1c} values of more than 9.5% were considered to indicate poor glycaemic control, less than 7.5% good control, and all values in between moderate control.

In addition the following were noted from the patient records: admissions to hospital and the number of clinic visits during the past 12 months as well as current therapy of patients.

Statistical analysis

Statistical analysis was performed using the SPSS statistical package. The Mann-Whitney and Wilcoxon's non-parametric tests were used for comparison of the number of clinic visits and number of hospitalisations between the study and control groups. Chi-square tests were done for comparison of variables with nominal frequencies . Process measure scores and other continuous data variables done repeatedly were analysed utilising the repeated measures analysis of variance (ANOVA) test. The consultation times at different visits were compared between the intervention and control groups as well as in relation to baseline, where an ANOVA test was done. A two-sided p-value of < 0.05 was considered significant.

Results

Patient demographics

At baseline there were no statistically significant differences between the intervention and control clinics with regard to patient demographics (Table I).

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Table I. Patient demographics for the intervention and control groups at baseline

Variable	Intervention N (%)	Control N (%)	p-value
Number	141 (47)	159 (53)	
Treatment			
Oral	69 (48.9)	91 (57.2)	
Insulin	43 (30.5)	42 (26.4)	0.34
Combination	29 (20.6)	26 (16.4)	
Male	52 (36.8)	57 (35.8)	0.67
Age (years) (mean (SD))	56.38 (13.00)	54.72 (14.46)	0.30
Duration of diabetes (mean (SD))	10.36 (7.47)	9.82 (7.72)	0.54

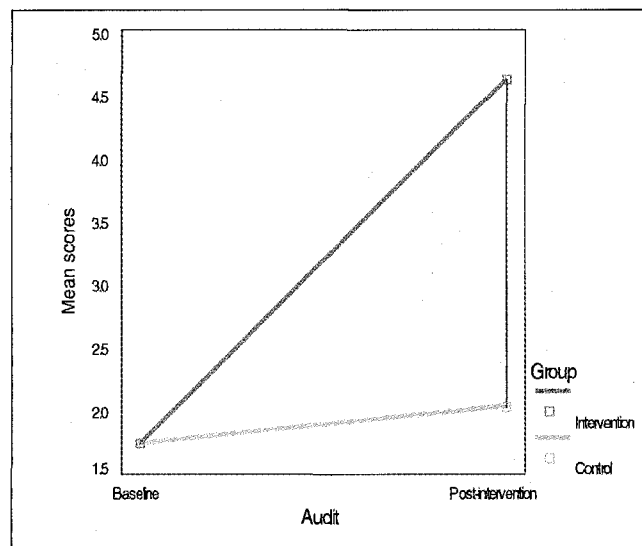Fig. 1. Profile plot indicating the change in mean scores from the baseline to post-intervention audit.

Clinic visits

The mean number of clinic visits for the intervention group at baseline was 4.97 per year (median 5.00, range 1 - 9). After the intervention this dropped to 3.7 visits per year (median 4, range 1 - 6) ($p < 0.01$). In the control group the mean number of clinic visits per year at baseline was 4.7 (median 5.0, range 1 - 11); post intervention this dropped non-significantly to mean 4.2 (median 4.00, 1 - 9) ($p = 0.13$). Over the 1-year time period from the baseline to the post-intervention audit a significant difference in the number of clinic visits was noted between the intervention and control groups ($p < 0.01$).

Process measures

At baseline no statistical difference in the mean process measure score could be demonstrated between the intervention and control groups ($p = 0.99$). After intervention the intervention group clearly scored better than the control group ($p < 0.01$).

Both the intervention and control groups showed an improvement in the average number of process measures patients received from baseline at the post-intervention audit, but only that of the intervention group was statistically

significant (intervention group: $p < 0.01$, control group: $p = 0.08$) (Table II).

A repeated measures ANOVA test indicated a significant change in scores between the two groups over time ($p < 0.01$) (Fig. 1).

HbA₁c

The mean of the last HbA_{1c} tests done before the baseline audit for both the intervention and control groups did not differ significantly (9.77% and 10.27% respectively, $p = 0.31$). Post intervention, although an improvement in the mean HbA_{1c} occurred in both the intervention and control groups, the difference between them was not significant (8.5% and 9.15% respectively, $p = 0.14$) (Table III). The HbA_{1c} change over time between the intervention and control groups did not differ significantly ($p = 0.60$).

The proportion of patients with poor glycaemic control diminished in both the intervention (from 47.4% to 36.8%) and

Table II. Comparison of process measures at baseline and after intervention for the intervention and control groups

Parameter	Intervention N = 141 (%)			Control N = 159 (%)		
	Baseline	After intervention	p-value	Baseline	After intervention	p-value
Foot examination	33 (23.4)	126 (89.4)	< 0.01	58 (36.5)	78 (49.1)	0.04
Eye examination	45 (31.9)	99 (70.2)	< 0.01	63 (39.6)	32 (20.1)	< 0.01
Test for micro-albuminuria	20 (14.2)	103 (73)	< 0.01	15 (9.4)	24 (15.1)	0.16
HbA₁c test	91 (65.5)	133 (94.3)	< 0.01	66 (41.5)	114 (71.7)	< 0.01
Lipid profile	29 (20.6)	99 (70.2)	< 0.01	24 (15.1)	54 (34)	< 0.01
Dietician visit	28 (19.8)	89 (63.1)	< 0.01	51 (32.1)	22 (13.8)	< 0.01
Score (mean (SD))	1.74 (1.53)	4.60 (1.48)	< 0.01	1.74 (1.59)	2.04 (1.38)	0.08

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Table III. Between-group and within-group comparison of HbA₁c at baseline and after intervention			
	Baseline mean HbA₁c (SD)	After intervention mean HbA₁c (SD)	p-value*
Intervention	9.77 (3.36)	8.48 (2.60)	< 0.05
Control	10.27 (3.60)	9.253 (3.29)	0.06
p-value†	0.31	0.54	

*p-value for within-group comparison (baseline v. after intervention).
†p-value for between-group comparison (intervention v. control group).

control groups (from 54.1% to 39.4%). The proportion of patients with good glycaemic control improved non-significantly in both the intervention group (from 32.6% to 39.6%, $p = 0.17$) and in the control group (from 25.2% to 37.9%, $p = 0.06$).

Consultation time

The difference in mean duration of consultations measured at various points for both the intervention and control groups indicated a significant difference in consultation time between the two groups ($p < 0.01$), with consultations in the intervention group (15.6 minutes) significantly longer than those in the control group (13.3 minutes).

Discussion

This was a physician-driven study, investigating the quality of diabetes care at the diabetes clinics of a tertiary care hospital. Quality of diabetes care was assessed before and after the implementation of measures aimed at improving the quality of care rendered, as well as in comparison with a control group without measures to improve the quality of care.

The care as indicated by certain process measures improved significantly from baseline and in comparison with the control group. It therefore seems that the intervention, which included a physician training programme and the introduction of a structured consultation schedule, was effective in improving the quality of care delivered to diabetic patients.

This intervention also seems to improve the glycaemic control of patients over time, although this was not statistically significant. Furthermore, the proportion of patients with uncontrolled diabetes decreased and the proportion of patients with good glycaemic control increased.

Data from the baseline audit of this study compare very poorly with those of audits related to the quality of diabetes patient care elsewhere in the world, where more than 70% of patients had HbA₁c levels measured annually, 40 - 90% of patients received foot examinations every year, and more than 50% underwent an annual eye examination.[11-14] After intervention the intervention group compared very favourably

with the quality of care delivered elsewhere in the world, e.g. 94% received a HbA₁c test, 89.4% underwent a foot examination and 70.2% had an eye examination (Table II). The quality of care as measured by process measures compared well with that of a primary health care record review done in Cape Town in 1996,[15] which indicated that only 6% of patients received a fundoscopic eye examination and 4.7% a foot examination.

Glycaemic control of patients in the intervention group compared well with that of patients in a large urban hospital in the USA, with 36.8% versus 31 - 43% of patients having uncontrolled blood glucose levels (HbA₁c > 9.5%).[14]

Glycaemic control reported in other South African studies seems to be comparable with glycaemic control at baseline of this study (Table III). Motala et al. report a mean HbA₁c of 9.8 ± 2.2% in an urban diabetes population with diabetes of more than 10 years' duration.[7] Rotchford and Rotchford[6] reported that in a rural diabetic population in KwaZulu-Natal only 22.5% of patients had an HbA₁c level of less than 8%. Acceptable glycaemic control (HbA₁c < 10%) was reported to be present in 49.4% of patients partaking in an audit done in Cape Town by Levitt et al.[5]

What is clearly different from the abovementioned USA hospital diabetes clinics is the number of patient visits, which on average varies between 8 and 15 visits per year.[16-18] This markedly exceeds that at the two Kalafong diabetes clinics (median 4 - 5 visits per year) but seems less than the mean number of clinic visits reported in two other South African studies (9.5 ± 12.1 and 9.5 ± 3.4).[5,6]

Quasi-experimental studies are the most commonly used designs in guideline implementation studies where there are practical and ethical barriers to the conduction of randomised controlled trials.[19] This study fulfilled the requirements of a controlled before-and-after design. Firstly, the study and control groups should have the same baseline characteristics and performance. In this study the intervention and control groups did not differ significantly with regard to baseline patient and clinic characteristics. Similarly with regard to outcome and process measures the intervention and control groups did not differ significantly at baseline.

Secondly, all other factors should be the same for both the intervention and control groups except for the intervention under investigation. During this study the nursing staff and all facilities remained the same for both the intervention and control groups. Thirdly, data should be collected at the same time for both groups before and after the intervention. All data were collected for both the intervention and control groups simultaneously at baseline and after intervention. The same person collected the data at baseline for both groups and after intervention for both groups. Fourthly, between-group analysis should be done comparing the study and control groups following the intervention. This was done for this study, and

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therefore the differences can be assumed to be due to the intervention.

An attempt to reduce bias was made throughout the study. Firstly, both the intervention and control groups were randomly selected for record auditing in an attempt to reduce selection bias, which is evident in the absence of significant differences in baseline parameters. Secondly, the two groups were kept separate as far as possible and patients in the intervention clinic were not allowed to change to the control clinic and vice versa. Thirdly, all doctors attending to diabetes patients were blinded as to which patients were selected for record auditing in an attempt not to influence the quality of care of patients selected for record auditing. Confounding by means of the Hawthorne effect (the non-specific beneficial effect of taking part in research) could not be prevented since all doctors taking care of diabetic clinic patients knew that they were being studied and signed informed consent. This might explain why the control clinic also showed improvement in the care and outcome measures, although to a lesser degree.

A limited number of measures was utilised to assess the quality of diabetes care in the two clinics studied, but more outcome measures, especially blood pressure, body mass index and low-density lipoprotein (LDL) cholesterol, could have aided in a more comprehensive assessment of patient outcome. Other than process measures and outcome measures, measures of patient education received in the diabetes clinics would also have been useful in the assessment of comprehensive patient care. However this would be much more difficult to measure.

In conclusion, this study provides evidence that a structured consultation schedule and a physician education programme improved the quality of diabetes care at a tertiary care diabetes clinic. However this improvement in quality of care comes at the expense of prolonged consultation time.

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