Does good practice organization improve the outcome of care for diabetic patients?

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SUMMARY

Background. *Audit of diabetic care is becoming common in general practice. Most of this audit is concerned with structure and process; outcome audit is much more difficult to achieve.*

Aim. *To determine whether the structure of general practice diabetic care influenced the process or outcome and whether efficiency of process predicted improved outcome.*

Method. *Cross-sectional survey, by questionnaire and review of notes, among general practices in the East Dorset district, involving diabetic patients identified from general practitioner (GP) disease registers or from a hospital diabetic register. The main outcome measures were the proportion of process and outcome measurements, related to selected structure criteria and the proportion of outcome measurements, related to appropriate process measurements. All associations were tested using the practice as the unit of analysis.*

Results. *Practices with a detailed diabetic register showed a positive association with a higher proportion of some process, but no outcome, measurements compared to those practices without such a registrar. A high proportion of process measurements did not correlate with improved outcome.*

Conclusion. *Assessment of the follow-up of diabetic patients in general practice by measurement of the structure or process of care does not allow the prediction of an improved outcome for those patients when summarized on a practice basis. There is no shortcut to the collection of data on outcome as a measure of the benefit of follow-up for diabetic patients.*

Keywords: diabetes mellitus; outcome; practice organization.

Introduction

Audit of diabetic care in general practice is becoming common, especially since the introduction of the compulsory requirements in the government's chronic disease management programme.[1]

As yet, most of this audit is concerned with structure and process; outcome audit is much more difficult to achieve, and is not, at present, required under the government programme. Outcome is, nonetheless, the most pertinent factor for the diabetic patient and the most interesting for the doctor. Poor outcome of care, for example the progression of diabetic retinopathy or the development of ischaemic heart disease, should have a stronger influence in changing a doctor's behaviour than anything else. This study, part of a district-wide audit of diabetic care in the community of East Dorset,[2] assessed whether gathering data on structure enabled the process and outcome of diabetic care to be predicted and whether carrying out process measurements on a high proportion of patients improved their outcome.

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Method

During the period of October 1992 to October 1993, we approached 51 practices in East Dorset: 45 (86.5%) agreed to participate. We asked the lead doctor in participating practices to complete a questionnaire on the structure of diabetic care within the practice (see Table 1). Details of this questionnaire were confirmed during a practice visit by questioning the doctors and practice staff as much as possible.

A total of 37 practices (72.5% of the 51 originally approached) agreed to be visited, by either the author (NRD) or his research assistant. At this visit, the notes of all the known diabetic patients in the practice were scrutinized for details of diabetic follow-up. Diabetic patients were identified from the practice's own register or, where this did not exist, using the central register of diabetics held at the hospital (six practices). A total of 3974 diabetic patients' notes were reviewed. Data were retrieved from written notes or from computer records where appropriate. We relied on practices to inform us of the best source of data. We recorded criteria widely agreed to be of particular importance to diabetic care.[3,4] These criteria are shown in Table 2. Outcome criteria were surrogate, i.e. they were readily measurable, and known to have a direct relationship to morbidity and mortality, although they were not necessarily disease states in themselves (see Table 2). Where there was more than one measurement of a certain outcome in the 13 months before the visit, we recorded the most recent result. The author and his research assistant met regularly every week to discuss progress and to solve any problems with the data or their coding, although there was no formalized system of quality control.

A selection of eight structure criteria were tested for association with specific process and outcome criteria (Table 3). These structure criteria were chosen either on the basis of considerable variation in response (e.g. postgraduate training in diabetes for the practice nurse: 58% of practices replied 'yes', 42% 'no') or because the question was of special interest on account of previously published material (e.g. the presence or absence of a GP diabetes 'specialist'[5]) or because of special local interest (e.g. the use of an optometrist for eye examinations: there is a well-established system for this in Poole, Dorset[6]). Altogether, 105 tests were performed: each structure criterion, except for 'availability of chiropody clinic' and 'availability of optometrist for eye examination', was tested for association with each of 17 process/outcome criteria in turn. 'Availability of chiropody clinic' was tested for association with the process criterion 'foot examination done', and 'availability of optometrist for eye examination' was tested for association with process criterion 'full eye examination done' and outcome criterion 'retinopathy present'.

Some important outcome criteria were then matched with relevant process criteria and tested for association on a practice by practice basis, as shown below:

1. Percentage HbA1c test done vs. average HbA1c result.
2. Percentage blood glucose test done vs. average HbA1c result.

3. Percentage serum creatinine test done vs. percentage with chronic renal failure (i.e. serum creatinine > 150 μmol l^{-1}).
4. Percentage full eye examination done (i.e. visual acuity (VA) and fundoscopy record) vs. percentage with retinopathy.
5. Percentage urinalysis done vs. percentage with proteinuria (i.e. > 0.3 g l^{-1}).
6. Percentage blood pressure (BP) done vs. percentage with hypertension (i.e. BP > 160 systolic, or BP > 90 diastolic, or both).

Analysis of the results was undertaken predominantly using non-parametric methods. Selected process and outcome criteria were compared between groups with or without specific structure criteria using Mann–Whitney *U*-tests. Confidence intervals were calculated based on the difference between the means of the two groups. Whether or not a larger percentage of patients having a process test done was correlated with a better outcome was tested using Spearman's rank correlation. All the tests were done using the practice as the unit of analysis.

Table 1. Structure questionnaire: positive replies (%) are shown in brackets (n = 45).

1	Age/sex register	(100)
2	Disease register of diabetic patients	(84)
3	Register of diabetic patients under hospital follow-up	(49)
4	Register of diabetic patients under GP follow-up	(36)
5	Appointment system for diabetic patients at follow-up	(91)
6	Recall system for follow-up	(71)
7	Nurse visits home, if patient does not attend	(4)
8	Audit facilities; structure protocol available for use	(18)
9	Audit facilities; process protocol available for use	(11)
10	Audit facilities; outcome protocol available for use	(4)
11	Urinalysis facilities	(100)
12	Venepuncture facilities	(91)
13	Height measurement facilities	(98)
14	Weight measurement facilities	(100)
15	Separate nurse's room	(91)
16	Snellen chart for visual acuity	(91)
17	Availability of optometrist for diabetic eye examination	(51)
18	Use of primary care chiropody service for diabetic foot examination	(42)
19	Ophthalmoscope in practice	(100)
20	Sphygmomanometer in practice	(100)
21	Practice nurse with specific diabetic training	(58)
22	GP with postgraduate diabetic training	(60)
23	One partner sees all diabetics for follow-up	(38)
24	Protected time in ordinary surgery for follow-up	(42)
25	Diabetic mini-clinic (i.e. dedicated session for diabetic patients only)	(84)
26	Facilities in practice for education	(64)

Results

The majority of the participating practices came from the conurbation of Poole and would be classified as inner city or suburban.

Table 2. Process and outcome criteria included in the audit.

(a) Particulars of the patient
- Age of patient
- Duration of disease
- Date last seen for diabetic check
- Type of diabetes
- Place of follow-up

(b) Process criteria (record in notes for last 13 months; yes or no)
- Weight
- Blood glucose
- HbA1c/fructosamine
- Creatinine
- Cholesterol
- Urinalysis, for proteinuria
- Foot examination
- Pedal pulses
- Blood pressure
- Eye examination for visual acuity
- Eye examination for retinopathy
- Eye examination for visual acuity and retinopathy
- Smoking habit
- Hospital communication

(c) Outcome criteria (actual value in notes, during last 13 months)
- Blood HbA1c/fructosamine, as a measure of glycaemic control
- Serum cholesterol, as a measure of macrovascular disease risk
- Serum creatinine, as a measure of kidney function
- Urinary protein, as a measure of kidney function
- Retinopathy (presence of any grade recorded as positive)
- Blood pressure (therapy for hypertension also recorded), as a measure of macrovascular disease risk
- Smoker or non-smoker, as a measure of macrovascular disease risk

Table 3. Prevalence of criteria used for testing of association between structure and process or outcome (for details of which associations were tested, see text).

Structure criteria Yes replies: n (%)	Process criteria, median % (interquartile range)	Outcome criteria median % interquartile range)
Register of diabetics 32 (86.5)	1. Patient not seen 13 (11–20)	12. HbA1c result 8.17 (7.99–8.41)
Register of diabetics discharged from hospital 12 (32%)	2. Blood glucose done 82 (71–90)	13. Chronic renal failure (creatinine > 150 mmol l–1) 5 (3–8)
Recall system 24 (65)	3. Hba1c done 80 (67–86)	14. Hypercholesterolaemia (cholesterol > 6.5 mmol l–1) 33 (28–46)
One partner sees all diabetics or 11/34 (32)	4. Creatinine done 37 (17–67)	15. Hypertension (> 160/90, either systolic diastolic, or both) 29 (23–33)
Practice chiropody clinic 15 (40.5)	5. Cholesterol done 16 (7–35) 6. Urinalysis done	16. Retinopathy 8 (6–11)
Use of optometrist for eye examination 19 (51)	61 (44–78) 7. Blood pressure done 83 (67–91)	17. Proteinuria (> 0.3 g l–1) 5 (2–7)
Nurse with diabetic training 20 (54)	8. Foot examination done 21 (12–35) 9. Full eye examination done 41 (33–50)	
Doctor with postgraduate diabetic training 23 (62)	10. Smoking history recorded 53 (35–64) 11. Weight done 62 (50–79)	

However, there were nine practices of a rural nature, situated in the eastern part of the county of Dorset, surrounding Poole. The mean practice list size was 7115 patients and the number of partners per practice varied from one to seven (mode three). The population of Poole is slightly weighted towards the elderly compared with the United Kingdom (UK) as a whole, with 21% aged between 60 and 79 years (UK 17.5%), and 5.5% aged 80 years or over (UK 3.5%) (1991 census figures). The number of diabetic patients per practice varied from 22 to 228, median 112 (interquartile range 54–156).

The analysis of the chosen structure criteria against process and outcome criteria did reveal some statistically significant associations. These are shown in Table 4, together with a selection of tests without significant results.

Analysis for associations between process and outcome criteria did not reveal any of statistical significance (Spearman's rho between 0.06 and 0.22, all $P > 0.15$). An example of one of the associations tested is shown in Figure 1.

Discussion

We tested 105 associations between individual structure and process/outcome criteria. This number of tests would be expected to reveal five positive associations at the 5% level, simply by chance. In fact, nine tests were significant. However, the associations between keeping a register of diabetic patients under GP follow-up and higher percentage of blood glucose tests, cholesterol tests, blood pressure tests, urinalyses and weights taken are all significant at the 2% level; the association between the register and higher percentage of HbA1c tests reaches significance at the 0.1% level. Thus, these results may reflect genuine associations, and the difference between the mean percentage of tests done (e.g. 64% HbA1c tests done if the practice had no register and 89% if it did) could be clinically important.

The lack of any other statistically significant associations is surprising, in that good organization would be expected, logically, to promote more efficiency. Even those practices that had no diabetic register, for example (16% of the total; see Table 1), managed to achieve some sort of diabetic follow-up. This must indicate considerable presence of mind on behalf of the doctors or practice nurses, who presumably carry out checks on an opportunistic basis. Furthermore, the absence of a recall system in the practice (29% of practices had none; see Table 1) does not make any significant difference to the proportion of tests done, although the time allowance for the measurement of process criteria was generous at 13 months. Some measurements should probably be done every six months (e.g. blood pressure, blood glucose, urinalysis[4]), and it is possible that a recall system would make some difference to the efficiency of this process.

Practices with a low percentage of completed process criteria will, by definition, have low numbers of outcome results (e.g. the proportion of patients receiving a full eye examination ranged from 72% to 0%), thus making comparisons of outcome difficult

Table 4. Some important associations tested, including all those with $P < 0.05$.

Structure criteria	Process/ outcome criteria	Means (%)		With–without difference of means (95% CI)	P value*
		With structure criterion	Without structure criterion		
Register of diabetic patients under GP follow-up	Blood glucose test done	89	73	16 (6, 26)	0.004
Register of diabetic patients under GP follow-up	HbA1c test done	89	64	24 (13, 36)	< 0.001
Register of diabetic patients under GP follow-up	Cholesterol test done	37	16	22 (9, 35)	0.009
Register of diabetic patients under GP follow-up	Blood pressure done	88	74	14 (5, 24)	0.004
Register of diabetic patients under GP follow-up	Urinalysis done	74	55	19 (4, 34)	0.012
Register of diabetic patients under GP follow-up	Weight taken	77	57	19 (5, 33)	0.011
Register of diabetic patients under GP follow-up	Mean Hba1c result	7.62	7.84	–0.22 (–0.84, 0.39)	0.546
Recall system	Blood pressure done	82	72	10 (0, 20)	0.049
Recall system	Blood glucose test done	80	74	6 (–5, 17)	0.265
Recall system	Mean Hba1c result	7.87	7.58	0.29 (–0.31, 0.89)	0.439
One partner sees all diabetics	Blood glucose test done	82	77	5 (–7, 17)	0.214
One partner sees all diabetics	Urinalysis done	72	56	16 (0, 32)	0.027
One partner sees all diabetics	Mean Hba1c result	7.61	7.79	–0.18 (–0.79, 0.43)	0.404
Availability of chiropodist	Foot examination done	61	47	14 (–1, 29)	0.101
Availability of optician	Full eye examination done	44	41	2 (–8, 13)	0.584
Availability of optician	Retinopathy present	13	10	3 (–5, 11)	0.530
Doctor with postgraduate training in diabetes	Blood glucose test done	79	78	1 (–11, 12)	0.851
Doctor with postgraduate training in diabetes	Mean Hba1c result	7.70	7.88	–0.18 (–0.78, 0.41)	0.112
Doctor with postgraduate training in diabetes	Cholesterol	74	59	15 (–1, 29)	0.049
Nurse with postgraduate training	Blood glucose test done	76	81	–5 (–16, 6)	0.419
Nurse with postgraduate training	Mean Hba1c result	7.61	7.94	–0.33 (–0.90, 0.24)	0.211

*Mann–Whitney U-test.

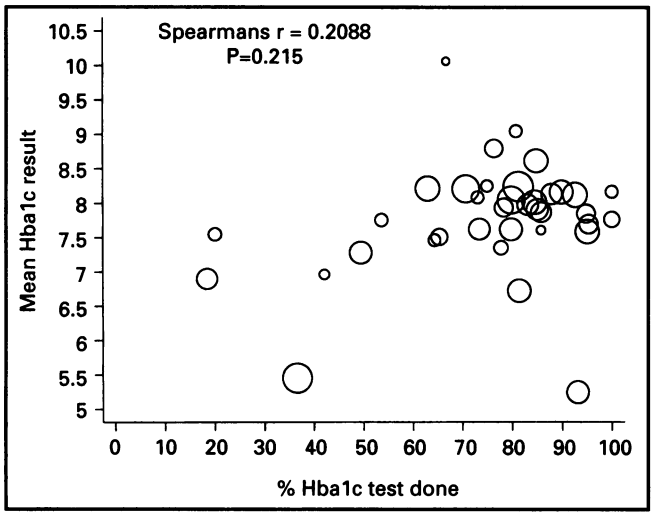

Figure 1. Plot of percentage Hba1c tests done vs. mean Hba1c result. The size of circles is proportional to the number of diabetic patients in each practice.

because of the possibility of a difference between the group with measurements done and that without any measurement. Nevertheless, even for tests carried out by the majority of practices on most of their patients, e.g. HbA1c tests, outcome was not, on average, improved among patients in the more highly organized practices compared with patients in less organized practices. This also applies to blood pressure measurement. This observation is important, as both HbA1c and blood pressure are comparatively easily influenced in the short term. Other outcome measures, e.g. retinopathy, are not so easily controlled.

There have been no similar studies looking at the correlation between process and outcome of diabetic care on a practice basis, although there are some published studies on structure. Jones and Marsden suggested,[7] based on the results of a qualitative survey in 54 practices, that major influences on the efficiency of proper patient follow-up include good organization, a recall system and a diabetic register. Proper education of the medical staff has been suggested as important by several authors.[8,9] This study was unable to confirm any of these hypotheses, although we did find some support for the importance of a diabetic register that includes details of those patients discharged from the hospital clinic.

The lack of association between a practice's efficiency in measurement of process criteria and any outcome criteria suggests either that there is no association or that those practices that measure fewer process criteria concentrate their efforts on those with known disease, not recording anything in the notes if the tests are normal. It is also possible that this survey was not sensitive enough, considering the relatively small number of practices involved. This also applies to the associations tested between structure and process or outcome criteria, with the low sample size being reflected in the wide 95% confidence intervals, as shown in Table 4. However, in view of the paucity of quantitative information on this topic, these results do have relevance and suggest that further research is needed. Of course, outcome among diabetic patients is influenced by many factors other than the relatively crude measures used here, for example the patients' perception of their disease, their motivation, and the enthusiasm of the doctors who deal with diabetes in the practice. The age, social, and ethnic structure of the practice population will also have some influence. Some of these factors do not lend themselves to quantitative research methods but should be investigated further using qualitative techniques.

The results of this survey are important to those organizations, such as family health services authorities and health commissions, who might use process or structure data from the chronic disease management programme to assess the 'performance' of practices in improving the health of diabetic patients. There is probably no shortcut to actually measuring outcome if we are to know how we are benefiting these patients.

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