Integrated care for diabetes: clinical, psychosocial, and economic evaluation

Diabetes Integrated Care Evaluation Team

Abstract

Objectives—To evaluate integrated care for diabetes in clinical, psychosocial, and economic terms.

Design—Pragmatic randomised trial.

Setting—Hospital diabetic clinic and three general practice groups in Grampian.

Patients—274 adult diabetic patients attending a hospital clinic and registered with one of three general practices.

Intervention—Random allocation to conventional hospital clinic care or integrated care. Integrated care patients seen in general practice every three or four months and in the hospital clinic annually. General practitioners were given written guidelines for integrated care.

Main outcome measures—Metabolic control, psychosocial status, knowledge of diabetes, beliefs about control of diabetes, satisfaction with treatment, disruption of normal activities, numbers of consultations and admissions, frequency of metabolic monitoring, costs to patients and NHS.

Results—A higher proportion of patients defaulted from conventional care (14 (10%)) than from integrated care (4 (3%), 95% confidence interval of difference 2% to 13%). After two years no significant differences were found between the groups in metabolic control, psychosocial status, knowledge, beliefs about control, satisfaction with treatment, unscheduled admissions, or disruption of normal activities. Integrated care was as effective for insulin dependent as non-insulin dependent patients. Patients in integrated care had more visits and higher frequencies of examination. Costs to patients were lower in integrated care (mean £1.70) than in conventional care (£8). 88% of patients who experienced integrated care wished to continue with it.

Conclusions—This model of integrated care for diabetes was at least as effective as conventional hospital clinic care.

Introduction

Although shared care for diabetes was suggested over 20 years ago,[1] many subsequent developments are more accurately termed shifted care, with patients discharged from hospital clinics to receive diabetic care in general practice.[2] General practitioners with protected time for miniclinics can be as effective as hospital clinics in maintaining metabolic control,[3] although deficiencies have been reported when patients are discharged to general practitioners without protected clinic time,[4,5] even when minimum standards of care have been agreed.[6] However, in a recent randomised trial non-insulin dependent patients allocated to general practitioners without miniclinics had lower default rates, were more consistently monitored, and had medical outcomes equivalent to those of patients remaining in hospital care.[7]

Several schemes in which hospital and primary care staff collaborate in the care of patients have been reported.[8,9] Patients receive routine care in general practice and an annual review in hospital, and information is exchanged through cooperation cards and letters, although computers may be used for appointments. In Newham hospital consultants conduct clinics with general practitioners and the system is administered by a central computer.[10,11]

The aim of this trial was to evaluate the effectiveness and efficiency of computer coordinated integrated care for insulin and non-insulin treated patients. We set out to investigate: how integrated care affects the process of care for diabetes and its outcome for patients; what benefits and costs integrated care generates for patients and for the NHS; and whether integrated care benefits one group of patients more than another.

Subjects and methods

We used a pragmatic randomised trial—that is, a trial designed to permit choices between alternatives in clinical practice. Pragmatism requires the incorporation of as many as possible of the conditions of normal clinical practice and minimisation of the demands to behave differently from usual. This differentiates the trial from the explanatory type, which is staged in an ideal setting.

All adult patients attending the Aberdeen diabetic clinic for at least one year and registered with any of three general practices were considered for inclusion. We excluded patients fulfilling any of the following criteria: age less than 18 years, pregnant or planning pregnancy, serum creatinine more than 200 μmol/l, medical problems requiring regular clinic attendance, not diabetic or having only impaired glucose tolerance. Patients were recruited when they attended for routine clinic appointments. Consenting patients were stratified by treatment (insulin or other) and randomly allocated to conventional clinic care or to integrated care.

ORGANISATION OF CARE

Patients allocated to integrated care were seen in general practice every three or four months and in the hospital clinic annually. Arrangements for routine consultations were at the discretion of each practice. Two practices ran diabetes miniclinics delegated to a single partner, whereas the third spread consultations among partners in routine surgeries. Practices received guidelines on the requirements of integrated care, including measurements and examinations to be undertaken, and on the current diabetes management policy. The box summarises the agreed division of responsibilities between general practice and the clinic. Clinic staff were not given protocols or guide-

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Protocol for integrated care

General practitioners' responsibilities

- At each visit:
  Review and optimise glycaemic control
  Record weight and results of urine analysis
  Measure venous plasma glucose and glycated haemoglobin
- During the course of each year check and record:
  Blood pressure
  Arterial pulses
  Visual acuity
  Condition of feet
  Tendon reflexes and sensory findings

Hospital clinic's responsibilities

- At the annual visit:
  Review and progress and plan management
  Perform funduscopy and record results
  Measure serum creatinine and glycated haemoglobin

lines. Patients allocated to conventional care were seen at roughly four monthly intervals, as before the trial.

Coordination of appointments and recall of patients in both arms of the trial were facilitated by the computer based patient record system,[12] which was run from the hospital clinic. Patients allocated to conventional care were sent computer generated letters reminding them of routine appointments at the clinic, and patients getting integrated care were invited to make appointments with their general practitioner. For integrated care the general practitioner received a computer generated reminder that the patient was due for consultation together with the most recent clinical details. After the appointment the practice added new information to the record and returned it to the clinic to be added to the computerised record. Updated records were returned to the practice to ensure consistency and completeness.

MEASUREMENTS

Metabolic control was measured at randomisation and at the final review two years later. Supine blood pressure was measured with a standard sphygmomanometer. Venous blood samples were taken to assess serum creatinine and glycated haemoglobin concentrations. Creatinine was measured by a modified Jaffe reaction[13] and glycated haemoglobin by ion exchange chromatography with the Daiichi system (reference < 5·3%) for samples obtained at randomisation and the Diamat system (reference < 6·0%) at the final visit. This change of measurement was an independent decision by the biochemistry laboratory. We also used body mass index (weight (kg)/(height (m)^2)) as an indicator of metabolic control.

Variables recorded at routine contacts with the general practitioner or clinic comprised the frequency of metabolic monitoring and screening for complications such as measurement of blood pressure, examination of feet, and contact with specialist services. Appointment letters included a questionnaire requiring the patient to rate the extent to which diabetes had been a problem over the past week, the numbers of diabetes related consultations and admissions over the past month, and the number of days that diabetes had disrupted normal activities.

We interviewed patients at home after the final review. They were asked to complete the diabetes health questionnaire, which measures psychosocial status and yields scores for depression, anxiety, eating problems, and social support[14]; the diabetes knowledge questionnaire[15]; the wellbeing and treatment satisfaction scales[15,17]; and a modified perceived control of diabetes scale.[18] Although the wellbeing scale measures depressed mood, anxiety, energy, and positive well being, only the total scores are reported here.

Patients also completed a questionnaire to estimate their costs in attending consultations,[19] and were asked open ended questions about advantages and disadvantages of conventional and integrated care.

Health service costs were derived by an appraisal of the total costs of diabetic care in the two larger practices. Estimates were obtained from interviews with hospital accountants, practice managers, and the diabetic care coordinator. The estimate of the costs of integrated care reflects the fact that the central coordinating system was already in place.

We processed and analysed data using SPSSX and SPSSPC. Categorical data were subjected to χ^2 tests and continuous data were subjected to t tests, analysis of variance, or analysis of covariance as appropriate. Data on patient costs were not normally distributed and were subject to t tests on the logarithms of the scores. Analysis was by intention to treat.

TABLE I—*Baseline data collected on patients at recruitment to trial. Values are means (SDs) unless stated otherwise*

	Conventional care (minimum n = 103)	Integrated care (minimum n = 117)	95% Confidence interval for difference
Age (years	59·6 (15·1)	58·1 (15·5)	−2·4 to 5·4
Duration of diabetes (years)	9·4 (10·6)	8·7 (8·6)	−1·8 to 3·2
Duration of clinic attendance (years)	8·9 (9·8)	8·3 (8·2)	−1·7 to 2·9
Glycated haemoglobin (%)	5·3 (1·4)	5·3 (1·4)	−3·6 to 3·6
Body mass index	28·3 (5·6)	27·6 (8·5)	−1·2 to 2·6
Creatinine (μmol/l)	90·4 (26·3)	88·9 (19·1)	−4·5 to 7·5
Systolic blood pressure (mm Hg)	153·9 (24·8)	155·9 (27·1)	−8·7 to 4·7
Diastolic blood pressure (mm Hg)	84·8 (11·5)	85·6 (15·6)	−4·4 to 2·8
No (%) of women	53 (48)	51 (41)	−6% to 19%
No (%) with insulin dependent diabetes	35 (32)	41 (33)	−14% to 10%
No (%) with evidence of retinopathy	35 (32)	27 (22)	2% to 22%
No (%) with evidence of neuropathy	26 (23)	25 (20)	−12% to 11%
No (%) with evidence of peripheral vascular disease	43 (39)	33 (27)	0·6% to 23%
Treatment (No (%))			
Diet alone	21 (19)	16 (13)	−3% to 15%
Metformin	20 (18)	27 (22)	−14% to 6%
Sulphonylurea	15 (14)	20 (16)	−12% to 6%
Metformin and sulphonylurea	20 (18)	20 (16)	−8% to 12%
Insulin	35 (22)	41 (33)	−14% to 10%

Results

Of 311 patients considered for inclusion, 27 were excluded by the stated criteria and 10 declined to participate. Our sample size of 274 gives 80% power of detecting at the 5% level of significance a difference between the two randomised groups equivalent to 33% of the standard deviation. A total of 135 patients were allocated to conventional care and 139 to integrated care. During the two years of the trial 21 patients died (10 in conventional care and 11 in integrated care). Fourteen (10%) patients in conventional care but only four (3%) in integrated care were lost to follow up through repeated failure to attend (95% confidence interval of difference 2% to 13%).

Of the 235 patients who completed the trial, 131 (56%) were men. Ages ranged from 18 to 86, with a mean (SD) of 58·8 (18·1). Seventy six (32%) were treated with insulin at randomisation and 159 (68%) with hypoglycaemic drugs or by diet alone. There were no significant differences between patients allocated to conventional and integrated care at randomisation (table I).

Before being told their random allocation, 139 patients said that they would prefer to remain in conventional care, 35 wanted to try integrated care, and 61 did not state a preference. Of those with a preference, 20 (37%) patients with insulin dependent diabetes compared with 15 (12%) with non-insulin dependent diabetes preferred to switch to integrated care (95% confidence interval 10% to 39%).

Patients having integrated care had more visits and higher frequencies of measurement and examination,

TABLE II—*Frequency of measurement and examination during routine visits in two years of trial*

Assessment	Mean (SD) No of assessments			No (%) with no record of assessment		
	Conventional care (n = 111)	Integrated care (n = 124)	95% Confidence interval for difference	Conventional care (n = 111)	Integrated care (n = 124)	95% Confidence interval for difference (%)
Routine diabetic care visits	4·8 (1·7)	5·3 (1·4)	0·9 to −0·1	0	0	
Glycated haemoglobin	1·3 (1·0)	4·5 (1·4)	3·5 to 2·9	24 (22)	0	14 to 29
Blood pressure	1·2 (1·0)	4·2 (1·4)	−3·3 to −2·7	23 (21)	0	13 to 28
Creatinine	0·7 (0·8)	0·5 (0·5)	0·03 to 0·47	49 (44)	67 (54)	27 to 3*
Visual acuity	0·7 (0·7)	2·6 (1·1)	2·1 to 1·7	56 (50)	2 (2)	39 to 58
Funduscopy	0·9 (0·7)	1·1 (0·6)	0·4 to −0·04	33 (30)	12 (10)	10 to 30
Peripheral pulses	0·5 (0·6)	1·9 (1·1)	1·6 to 1·2	62 (56)	8 (7)	39 to 60
Neurological examination	0·5 (0·6)	1·9 (1·1)	−1·6 to −1·2	65 (59)	9 (7)	41 to 62
Feet	0·5 (0·6)	1·4 (1·0)	1·1 to 0·7	64 (58)	27 (22)	24 to 48

*Not significant

except for creatinine, than patients in conventional care (table II). In conventional care, the age of the patient was negatively correlated with frequency of measuring glycated haemoglobin ($r = -0·44$, 95% confidence interval −0·58 to −0·28), measuring visual acuity ($r = -0·33$, −0·49 to −0·16), and doing funduscopy ($r = -0·29$, −0·45 to −0·11). There were no such correlations in integrated care. For all assessments except creatinine the proportions of patients for whom there was no record of measurement during the two years of the trial were significantly greater in conventional care. Forty four (40%) patients in conventional care had seen a dietitian versus 32 (26%) in integrated care (2% to 26%), but only 29 (26%) patients in conventional care had seen a chiropodist versus 72 (58%) in integrated care (−44% to −20%).

The metabolic control of patients having conventional and integrated care did not differ significantly at the end of the trial (table III). Separate analyses for insulin dependent and non-insulin dependent patients also found no differences between the two types of care. However, body mass index fell by 0·7 (SD 4·0) between recruitment and final review in non-insulin dependent patients in conventional care but rose by 1·4 (SD 6·3) among those in integrated care (95% confidence interval of difference in means −3·7 to −0·4).

We did not combine the findings from non-insulin dependent and insulin dependent patients on knowledge, psychological wellbeing, beliefs on control of diabetes, and satisfaction with treatment since the scores derive from measures with different contents. For non-insulin dependent patients only two variables showed differences between conventional care and integrated care, with patients in integrated care giving lower ratings to the degree of support from partners and believing more strongly that their condition was under the control of their doctors (table IV). There were no differences among insulin dependent patients.

The mean rating of diabetes as a problem over the preceding seven days was 0·17 (SD 0·49) for patients in integrated care and 0·29 (SD 0·49) for those in conventional care (−0·22 to −0·02). There were no significant differences between the two groups in the numbers of unscheduled consultations related to diabetes, admissions for diabetes, or days on which normal activities were disrupted.

TABLE III—*Mean (SD) values for measures of metabolic control at end of trial*

	Conventional care (n = 106)	Integrated care (n = 120)	95% Confidence interval for difference
Glycated haemoglobin*	5·3 (1·7)	5·3 (1·7)	0·31 to 0·037
Body mass index	27·9 (4·5)	28·7 (7·6)	−2·4 to 0·8
Creatinine (μmol/l)	100·6 (29·8)	102·2 (28·8)	−9·3 to 6·1
Systolic blood pressure (mm Hg)	156·4 (25·7)	161·5 (25·1)	11·7 to 1·5
Diastolic blood pressure (mm Hg)	83·5 (9·9)	84·3 (11·1)	3·5 to 1·9

*The comparison between the two groups on glycated haemoglobin for which we had baseline information on a different scale from that collected at final review, was performed by analysis of covariance. The reported means have been adjusted at the mean level of the baseline scale

PERCEIVED ADVANTAGES AND DISADVANTAGES OF INTEGRATED CARE

The most commonly perceived advantage of integrated care was accessibility (162 patients), followed by time savings (99), continuity of care (45), and the costs of attending appointments (28). Sixty two (50%) patients in integrated care mentioned time saving compared with 38 (34%) in conventional care (3% to 29%). There were no significant differences between non-insulin dependent and insulin dependent patients in either arm of care.

The most commonly perceived disadvantage was quality of care (66 patients), followed by continuity of care (14). Only 25 (20%) patients in integrated care mentioned quality of care compared with 40 (36%) in conventional care (−28% to −5%). Fifty (66%) insulin

TABLE IV—*Final measures of knowledge and psychological variables*

	Non-insulin dependent patients			Insulin dependent patients		
	Conventional care Mean (SD) (n = 50)	Integrated care Mean (SD) (n = 57)	95% Confidence interval for difference	Conventional care Mean (SD) (n = 23)	Integrated care Mean (SD) (n = 28)	95% Confidence interval for difference
Knowledge of:						
Diabetes	42·5 (35·0)	45·4 (31·8)	−13·4 to 7·6	28·9 (23·9)	25·9 (19·8)	−7·0 to 13·0
Urine and blood testing	13·2 (35·0)	14·9 (23·9)	−11·0 to 7·6	26·1 (28·1)	26·5 (25·9)	−12·8 to 12·0
Foot care	12·2 (16·3)	15·1 (16·4)	−8·0 to 2·2	29·1 (21·4)	29·0 (22·1)	−14·7 to 14·9
Diet	34·9 (24·4)	33·9 (23·1)	−6·4 to 8·4	39·9 (28·5)	44·7 (27·8)	−17·7 to 8·1
General management	25·6 (20·8)	25·5 (22·5)	−6·7 to 6·9	32·5 (23·6)	34·9 (23·3)	−13·1 to 8·4
Total knowledge score	23·7 (17·6)	25·2 (17·8)	−7·0 to 4·0	34·5 (23·5)	36·1 (22·8)	−12·2 to 9·0
Diabetes health questionnaire:						
Eating problems	31·2 (22·5)	34·6 (21·4)	−10·9 to 4·1	32·0 (14·6)	25·3 (15·6)	−1·3 to 14·7
Anxiety	19·2 (16·9)	15·5 (12·7)	−1·6 to 9·0	26·9 (17·5)	23·2 (19·9)	−6·2 to 13·6
Depression	12·9 (15·9)	16·3 (14·8)	−8·7 to 1·9	15·1 (13·2)	11·4 (9·9)	−2·6 to 10·0
Support	8·3 (6·2)	16·0 (6·6)	−10·0 to −4·5*	12·6 (6·8)	15·5 (7·7)	−6·8 to 1·0
Beliefs in:						
Personal control	41·8 (11·5)	43·8 (9·9)	−5·9 to 1·9	71·7 (12·2)	69·4 (13·9)	−5·5 to 10·1
Medical control	11·0 (8·7)	7·6 (6·8)	0·5 to 6·3*	18·3 (9·6)	17·3 (10·1)	−4·5 to 6·5
Situation control	9·7 (6·9)	8·2 (6·8)	−1·1 to 4·1	13·5 (9·6)	14·6 (10·0)	−6·7 to 4·4
Satisfaction with treatment	41·1 (6·2)	42·3 (5·6)	−3·3 to 0·9	49·8 (7·5)	51·9 (7·5)	−6·0 to 1·8
Wellbeing	47·1 (7·5)	46·5 (6·7)	−1·8 to 3·0	67·5 (12·4)	65·3 (11·2)	−4·1 to 8·5

*Significant at the 5% level

dependent patients in conventional care mentioned quality of care compared with only seven (19%) of the non-insulin dependent patients in conventional care (30% to 64%). There were no such differences between insulin dependent and non-insulin dependent patients in integrated care.

When asked whether they would take the opportunity of visiting or continuing to visit their general practitioner for diabetic care, 186 patients said that they would. One hundred and nine (88%) of the patients who had had integrated care answered affirmatively compared with 77 (69%) of those who had had integrated care (9% to 30%). Seventy nine (95%) non-insulin dependent patients in integrated care said they wished to continue but only 30 (74%) insulin dependent patients (6% to 37%). Sixty five (86%) non-insulin dependent patients in conventional care said they would switch to integrated care compared with 23 (66%) insulin dependent patients (2% to 37%).

COSTS

In conventional care the mean annual cost per patient year was £55. In integrated care the mean annual cost per patient year was estimated as £78 in one practice and £101 in the second. The discrepancy between the two practices is partly explained by differences in their organisation of care. The first practice spread diabetic appointments throughout routine surgeries and among all general practitioners; patients were typically seen twice a year and spent 10 minutes with a practice nurse and 10 minutes with the doctor. The second practice ran a weekly diabetic clinic under a single doctor; many patients attended three times a year and spent 20 minutes with the health visitor and 20 minutes with the doctor. Table V shows the breakdown of these costs including the administrative costs of running the integrated care scheme.

TABLE V—*Annual costs per patient for integrated and conventional care*

	Integrated care		
	Urban practice (£)	Coastal practice (£)	Conventional care (£)
Practice appointments:			
Staff	10·87	16·24	
Administrative cost*	5·34	5·74	
Building	1·52	2·60	
Consumables	0·56	0·43	
Cost/appointment	18·29	25·01	
Actual No of appointments	2·5	2·75	
Annual cost	45·72	68·77	
Hospital appointments:			
Staff	18·32	18·32	18·32
Administrative cost*	5·34	5·74	
Building	3·10	3·10	3·10
Consumables	1·56	1·56	1·56
Cost/appointment	28·32	28·72	22·98
Actual No of appointments	1·15	1·13	2·4
Annual cost	32·57	32·45	55·15
Total costs	78·29	101·22	55·15

*During the trial the administrative costs of integrated care were met from the hospital budget.

There was a significant difference between patient borne costs in conventional care and integrated care. The mean costs per visit were £8 (95% confidence interval £5.23 to £12.12) for conventional care and £1.70 (£1.16 to £2.47) for integrated care. The ratio of the two means was 4·7 (2·7 to 8·3).

Discussion

Integrated care was as effective as hospital based care in achieving standards of metabolic control and maintaining patients' knowledge of diabetes and their general wellbeing. The minimum standards for screening for complications were met more effectively in the integrated care group than in those attending the hospital clinic only. This was true even for funduscopy, which was carried out almost exclusively at the hospital clinic for both groups. This difference is partly explained by the fact that patients in the conventional care group who were known to be attending an ophthalmology clinic were not screened in the diabetes clinic. Screening tended to be less comprehensive at the hospital in older patients despite the high risk of vascular and neuropathological complications.

The differences in rates of screening can be partly explained by the availability of a written management protocol in the integrated care group. However, similar differences have been found in other randomised trials of shared care[7 20] and where general practice minichnics have been compared with hospital clinics.[21] The large throughput of patients in hospital clinics may militate against higher screening rates.

The weight gain in non-insulin dependent patients in integrated care may reflect the reduced access to specialist dietetic services. Access to a community dietitian was a main factor affecting metabolic control in a multivariate analysis in general practice.[22] In the same study the health of patients, health locus of control, and knowledge of diabetes were not significantly related to glycaemic control. These factors are, however, important measures of wellbeing and did not differ between patients in the two forms of care in our study.

A longer follow up would be required to detect any differences between the groups in incidence or severity of long term complications and the implications for morbidity and mortality attributable to diabetes. If introduced widely the integrated care model described would update clinical data on a regional basis and permit regional audit of process and standards of care and clinical outcomes. The St Vincent declaration has set European targets for diabetic care,[23] and centralised collection of data will be essential if these targets are to be met.

Over the two years mortality was similar in the two groups, but, as in the Islington study,[7] the default rate was significantly higher in the conventional care group. This is important because loss to follow up has been shown to be associated with increased risk of developing diabetic complications.[24]

COSTS

The costs to the health service of consultations in conventional care and integrated care were similar but fell on different providers, which may be important in the new NHS internal market. About 30% of the costs of integrated care were due to maintaining the clinical database and operating the appointment prompting system. At present these costs are met from the hospital budget. The costs of conventional and integrated care are greatly influenced by the organisation of care within each site. Patients who previously defaulted from regular clinic review and patients who attend general practitioners on an ad hoc basis may find integrated care more acceptable. This may mean that a higher percentage of the diabetic population would have regular review, screening, and intervention. Widespread implementation of integrated care could thus increase the demand for resources both in clinics and in general practice. Costs to patients were generally lower for patients in integrated care than for those in conventional care, particularly for those living a long way from the hospital.

IMPLICATIONS

This trial is similar to the randomised trial of prompted community care carried out in Islington,[7] but there are some important differences. We included both insulin dependent and non-insulin dependent diabetic patients, and they were represented in both

Practice implications

- Diabetes mellitus affects 1-2% of the population in Britain
- Life long surveillance is necessary to prevent and detect the long term complications
- In this study integrated care coordinated by a computer system was as effective at maintaining metabolic control as hospital clinics
- The complication screening programme was delivered more effectively in integrated care
- Integrated care may help improve management of diabetes since it was popular with patients and had a lower default rate than hospital based care

arms of the study in proportion to their prevalence in the general diabetic population.[25] There was no evidence that integrated care was less effective for insulin dependent patients than non-insulin dependent patients, though there were differences between these groups in their attitudes to integrated care. The insulin dependent patients tended to favour integrated care because of the perceived advantages of convenience. At the same time, they were initially more suspicious that integrated care would result in a reduction in the quality of care, although they did not find this to be true in practice.

The concept of integrated care was popular with patients, particularly those who experienced it directly. The participating general practitioners were interested in diabetes, and may have provided better care than might be found elsewhere.[21] Nevertheless, the results suggest that integrated care using the model described would be suitable for most patients. A centralised prompting system would allow participation by small practices that may not be equipped for recalling patients, and an annual hospital review accommodates practices not wishing or able to provide comprehensive care. It also provides an opportunity for continuing education of the primary care team through the letters sent from the hospital clinic after these visits. Collection of all data centrally is necessary to audit the process, standards, and outcomes of care in the longer term.

Our model of integrated care was at least as effective in all important respects as the traditional hospital clinic model and fulfils the principle that "shared care should be organised to provide a variable ratio of hospital to practice visits that is determined by the skills and wishes of the practitioners concerned and the preferences and needs of the patients."[26] We hope to expand this system within Grampian in the near future.

Members of the diabetes integrated care evaluation team were Simon Naji, Isobel Cameron, Ian Russell (Health Services Research Unit, Aberdeen); Roderick Harvey, Mhoira Leng, Kenneth McLeod, Lilian Murchison, Donald Pearson, Frances Philip, Michael Williams (diabetes clinic, Aberdeen Royal Hospital NHS Trust); Bucksburn Health Centre; Huntly Health Centre; and Peterhead Health Centre.

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1 Mahns JM, Stuart JM. Diabetic clinic in a general practice. *BMJ* 1971;iv:161
2 Thorn PA, Russell RG. Diabetic clinics today and tomorrow: mini clinics in general practice. *BMJ* 1973;ii:534-6.
3 Singh BM, Holland MR, Thorn PA. Metabolic control of diabetes in general practice: comparison with a hospital clinic. *BMJ* 1984;289:726-8.
4 Wilkes E, Lawton EE. The diabetic, the hospital and primary care team. *J R Coll Gen Pract* 1980;30:199-206.
5 Hayes TM, Harries J. Randomised controlled trial of routine hospital clinic care versus routine general practice care for type II diabetics. *BMJ* 1984;289:728-30.
6 Day JL, Humphreys H, Alhan-Davies H. Problems of comprehensive shared diabetes care. *BMJ* 1987;294:1590-2.
7 Hurwitz B, Goodman C, Yudkin J. Prompting the clinical care of non-insulin dependent (type II) diabetic patients in an inner city area: one model of community care. *BMJ* 1993;306:624-30.
8 Reith SBM. Caring for diabetics in central Scotland. *Diabetic Med* 1985;2:417-28.
9 Worth RC, Nicholson A, Bradley P. Shared care for diabetes in Chester: preliminary experience with a 'clinic-wide' scheme. *Practical Diabetes* 1990;7:266-8.
10 Kopelman P, Keable-Elliot D. An inner city district diabetic care scheme. *Diabetic Med* 1990;7:558-60.
11 Kopelman P, Mitchell JC, Derrett CJ, Keast R, Sanderson A. A computerised system (DIASHARE) for the management and evaluation of diabetic care (abstract). *Diabetic Med* 1992;9:S44.
12 Petrie JC, Robb OJ, Webster J, Scott AK, Jeffers TA, Park MD. Computer assisted shared care in hypertension. *BMJ* 1985;290:1060-3.
13 Husdan H, Rappaport A. Estimation of creatinine by the Jaffe reaction: a comparison of three methods. *Clin Chem* 1968;14:222-38.
14 Meadows KA, Brown KG, Thompson C, Wise PH. The diabetes health profile (DHQ): preliminary validation of a new instrument [abstract]. *Diabetic Med* 1989;6:S6.
15 Meadows KA, Fromson B, Gillespie C, Brewer A, Carter C, Lockington T. Development, validation and application of computer-linked knowledge questionnaires in diabetes education. *Diabetic Med* 1988;5:61-7.
16 Bradley C, Lewis KS. Measures of psychological well-being and treatment satisfaction developed from the responses of people with tablet-treated diabetes. *Diabetic Med* 1990;7:445-51.
17 Bradley C, Meadows KA, Sowden AJ. *General well-being and satisfaction with treatment scales for use with people with diabetes requiring insulin. 1. Psychometric development and retranslation of the English, French and German versions.* Copenhagen: World Health Organisation Regional Office for Europe, June 1992.
18 Bradley C, Brewin CR, Gamsu DS, Moses JL. Development of scales to measure perceived control of diabetes mellitus and diabetes-related health beliefs. *Diabetic Med* 1984;1:213-8.
19 Meldrum P. *Costing routine ante-natal visits.* Aberdeen: Health Economics Research Unit, University of Aberdeen, 1989. (Discussion paper No 02/89.)
20 Hoskins PL, Fowler PM, Constantino M, Forrest J, Yue DK, Turtle JR. Sharing the care of diabetic patients between hospital and general practitioner: does it work? *Diabetic Med* 1993;10:81-6.
21 Parnell SJ, Zalin AM, Clark CWF. Care of diabetic patients in hospital clinics and general practice clinics: a study in Dudley. *Br J Gen Pract* 1993;43:65-8.
22 Pringle M, Stewart-Evans C, Coupland C, Williams I, Allison S, Sterland J. Influences on control in diabetes mellitus: patient, doctor, practice or delivery of care? *BMJ* 1993;306:630-4.
23 Krans HMJ, Porta M, Keen H. *Diabetes care and research in Europe: the St Vincent declaration action programme.* Copenhagen: World Health Organisation Regional Office for Europe, 1992.
24 Hammersley MS, Holland MR, Walford S, Thorn PA. What happens to defaulters from a diabetic clinic? *BMJ* 1985;291:1330-2.
25 Wong JSK, Pearson DWM, Murchison LE, Williams MJ. Prevalence of diabetes mellitus in North East Scotland [abstract]. *Diabetic Med* 1991;8:28A.
26 Horne PD, Walford S. Diabetes care: whose responsibility? *BMJ* 1984;289:713-4.

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ANY QUESTIONS

If during attempted resuscitation of a patient with an asystolic arrest neither intravenous access nor intubation were achieved should intracardiac adrenaline be given?

There is no place for intracardiac injection. It interrupts external cardiac massage, may cause major cardiac injury, and is an unreliable way to access the central circulation. Basic life support should preferably be continued until someone capable of achieving intravascular access and endotracheal intubation can be summoned.[1] As the main benefit of adrenaline in cardiopulmonary resuscitation is believed to be its effect on peripheral α receptors there is no particular benefit to intracardiac adrenaline.[2] If peripheral veins are difficult, cannulation of or direct injection into the jugular vein (below the point where the sternal and clavicular heads of sternomastoid meet), subclavian vein (supraclavicular technique), or even femoral vein would be much safer and easier than intracardiac injection. If intubation and vascular access failed I would prefer to resort to direct intratracheal injection of adrenaline followed if necessary by percutaneous tracheostomy.—THOMAS WOODCOCK, *consultant anaesthetist, Southampton*

1 European Resuscitation Council guidelines (basic life support). *Resuscitation* 1992;24:103-10.
2 European Resuscitation Council guidelines (advanced life support). *Resuscitation* 1992;24:111-21.