Adjusting Follow-up Intervals in a Diabetic Clinic: Implications for Costs and Quality of Care

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It is obvious that follow-up interval is one of the main determinants of the cost of out-patient care for chronic disease. It is also obvious that to lengthen follow-up intervals will create 'free time' in an out-patient clinic, so that either the number of sessions can be cut or more patients who are not at present attending an out-patient clinic can be given appointments. What is not known is how critical is the follow-up interval to the outcome of care, and by what degree follow-up intervals would have to be lengthened to create a given number of 'free' appointments. Indeed, many clinicians running out-patient clinics for diabetics do not even know how many patients attend their clinic.

Hill[1] and Day[2] have given guidelines on the organisation of care for diabetics and a number of alternative systems of care are in operation[3–5]. For example, in Poole[4] general practitioners care for nearly all well-controlled uncomplicated maturity onset diabetics and some insulin-treated diabetics with good control. The return of many patients to the routine care of GPs allowed one of the two weekly diabetic clinics to be devoted entirely to the screening for and follow-up of diabetic retinopathy. Home and Walford[6] emphasised the role of the specialist clinic in collaboration with general practice. However, Hurwitz *et al.*[7] pointed out that probably only 50 per cent of known diabetics in a health district have the support of a diabetic clinic, and many consultants consider that their clinics are full and cannot make further contributions without additional resources. While overall assessments have been made of shared care schemes, little investigation has been made of the cost-effectiveness of methods used to run out-patient clinics.

The diabetic clinics at University Hospital, Nottingham, are supported by a register and information system[8], which allows a wide range of clinical information to be collected and summarised in standard medical records and it uses an integral appointments system in the management of the clinic. The medical record includes a problem list, comprising a complete summary of both active and inactive medical, social and psychological problems. This is constructed from information collected during the consultation using a checklist of diabetes related problems and free text entry for other problems. This article describes how a computer-based register can be used (a) to investigate how closely current follow-up intervals meet the observed clinical characteristics of patients; (b) to estimate by how much follow-up intervals need to be lengthened to allow regular examination of diabetics currently not attending, and (c) to monitor the effects of changes in follow-up interval on clinical outcomes. None of these three actions is possible without such a system.

Patients and Methods

Clinics

The diabetic clinic under study is held twice weekly and in 1983 a total of 4,860 attendances was made by 2,226 patients, of whom 54 per cent were male and 46 per cent female, 59 per cent were insulin-treated, 27 per cent tablet-treated and 14 per cent treated by diet alone. The mean age was 51 years and the mean duration of diabetes 12 years.

'Follow-up interval' was defined as the period in months from the last attendance to the next booked appointment. Clinical information in the computer-held medical records[8] has been analysed, to identify important determinants of high or low frequency of attendance, by cross-tabulations of various characteristics against follow-up interval and by a stepwise multiple logistic regression analysis using the statistical package GLIM (Release 3)[9]. For the cross-tabulations the follow-up interval, in periods of four months, was compared against age in 20 year bands, sex, duration of diabetes (10-year groups), treatment type (insulin or non-insulin treated), total glycosylated haemoglobin (Hba1) (steps of 5 per cent), retinopathy (any or none), neuropathy (any or none), number of problems on problem list and doctor

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seen. In the multiple logistic regression analysis the characteristics of patients with follow-up intervals of less than 6 months and of 6 months or more were compared. The independent variables were added and subtracted from the model until a 'best' model was found to which no other variable made a significant contribution. The independent variables included age, any retinopathy, new vessels, Hba1, duration of diabetes, any neuropathy, number of problems, and doctor seen. The analysis was performed after the population had been partitioned by sex and type of treatment.

Choice of Follow-up Intervals

An experiment was conducted to examine the level of agreement between clinicians in their choice of follow-up intervals for different patients, and to identify those clinical characteristics which were the principal determinants of the length of the interval.

Six patients were chosen at random from the list of attenders for each of five clinicians (three consultants, two registrars). The clinicians were presented with computer-produced summaries with identification details deleted and copies of the most recent consultation records. A balanced incomplete block design[10] was used to allocate patients' records to doctors. In addition each doctor was asked to estimate the optimal follow-up interval for 12 patients of other doctors. These were combined with the intervals allocated for the six patients seen in the clinic, so that follow-up intervals were available for 18 patients. The combined results were presented and the doctors asked to justify the intervals they prescribed. The difference between intervals allocated in the clinic and those estimated in the experiment were investigated for each doctor, using a Mann-Whitney U-test on the difference between his estimations and the mean of other estimations for each patient.

Estimation of Resource Use

The effect of variation in follow-up intervals on the use of resources in the clinic was studied. The diabetic clinics under study operate on fifteen minute appointments and in total there are approximately 60,000 doctor/patient consultation minutes per year. Base-line figures were used to estimate the effects of increases in follow-up intervals in terms of either additional consultations available or increases in the mean duration of an individual consultation. These estimates were combined with current costs to determine the revenue consequences for outpatient services and costs to patients. Some costs are fixed according to clinic time, including costs of clinic receptionists, doctors' time per session and nursing staff. Some costs are dependent on booked appointments; these include clinic preparation costs, blood and urine tests and patient travelling and time. Other costs are partly fixed, being dependent on the number of attendances and on the clinic population size. For example, the work of the records clerks and secretaries will be more per attendance for a patient who attends relatively infrequently than for a frequent attender, mainly because of the work in setting

up new documents for new referrals. In addition, there is also a workload associated with running a clinic, for example, preparation of clinic lists, regardless of the number of attenders. On the basis of an activity analysis of personnel it has been assumed that the costs of records clerks, secretaries, doctors' clinic time not related to patient contact, postage and stationery are approximately divided as 40 per cent fixed, 40 per cent per attendance and 20 per cent per patient in the clinic population. The doctors' time outside patient contact was estimated as equal to consultation time to allow for activities such as students and junior doctors 'sitting-in' on the consultation, and dictation of letters. For costing purposes it has been assumed that the total time spent on a visit to the clinic by each patient remains the same even if the consultation increases from 15 to 19.5 minutes and that if further patients are recruited to the clinic their travelling and time costs are the same as those of the current attenders. Salary costs have been calculated using mid-points of the relevant salary scales. (Details of costings are available from the authors.)

Results

Follow-up Intervals

Figure 1 shows the percentage of clinic attenders with given follow-up intervals for a typical month (May 1983). The mean interval was 5.8 months but there is a strong 'digit preference' for 6 and 12 months.
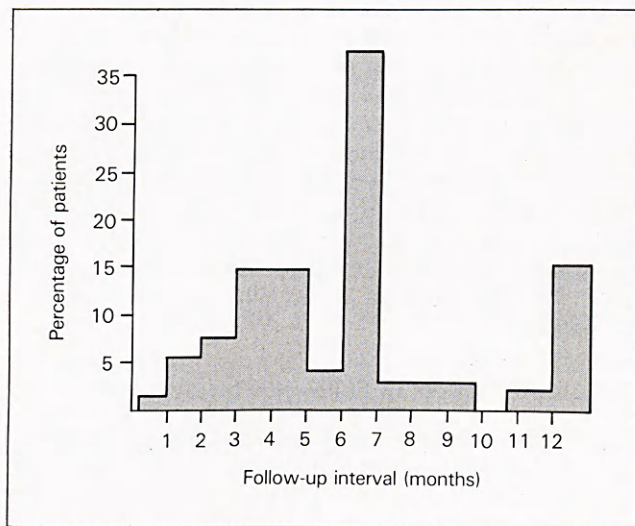

Fig. 1. *Follow-up intervals of diabetics attending an outpatient clinic.*

Cross-tabulations showed that shorter follow-up intervals were associated with young insulin-treated diabetics, poor control and retinopathy, but not with maturity onset diabetes, total number of problems on the problem list, or neuropathy. The length of follow-up interval was strongly associated with the doctor seen.

Table 1 summarises results from the multiple logistic regression analysis for follow-up intervals of less than 6

Table 1. 'Best' models from multiple logistic regression analysis showing significance of predictors and variation explained by each model. Doctor—doctor prescribing follow-up interval; Hba1—last recorded haemoglobin A1; retin—presence of any retinopathy.

| Predicted variable | Clinical characteristics with high predictive value | | | |
| | Insulin treated | | Non-insulin treated | |
	M	F	M	F
Follow-up interval < 6 months	Doctor** Age**	Doctor** Hba1**	Doctor** Hba1** retin*	Doctor** Hba1**
Variation explained	16%	10%	10%	10%

*P < 0.05; **P < 0.001

Table 2. Effects of increases in follow-up intervals on clinic resources.

Follow-up interval Increase(%)	Months	Additional 15-minute appointments	Mean duration of consultations (min)
Current position	6.7	0	15.0
+ 10	7.3	443	16.8
+ 20	8.0	666	18.0
+ 30	8.7	928	19.5
+ 40	9.4	1148	21.0
+ 50	10.0	1339	22.5

months. The doctor seen and Hba1 are the most consistent predictors of follow-up intervals. However, the percentage of the variation explained by the models never exceeds 16 per cent.

Clinical Decision-Making

The estimation of follow-up intervals in the experiment using medical records showed a significant difference (F = 17.5; 4 and 56 df; P < 0.01) between doctors. For one doctor in particular, intervals allocated in the clinic were much shorter (U = 6; SD(U) = 10.7; P < 0.005) than those allocated 'blind' using patient records alone. The variation in intervals allocated for individual patients was considerable; for example, three weeks when seen in the clinic and three and four months when using the medical record only. During the course of the discussion of the preliminary results, doctors revised their estimates in the light of information not available from the computer record or photocopied notes, such as missing entries from the problem list. There were no significant differences between clinicians for the revised estimates. In their judgement an increase in the prescribed follow-up intervals, for example from six to nine months, would be acceptable.

Effects of Changes in Follow-up Intervals

Table 2 shows the number of free appointments of 15 minutes' length which would be created or, alternatively, the increased duration of a consultation produced by incremental increases in follow-up intervals. An increase of 30 per cent, which, for example, would mean increasing an interval of six months to almost eight months, would free just under 1,000 fifteen-minute appointments.

Table 3 presents the costs, in terms of patients' travelling time, medical and nursing staff costs and administrative costs of attendance, for three options: (a) a clinic population of 2,226 attenders and a mean follow-up interval of 6.7 months; (b) an increase in all intervals by 30 per cent so that these 2,226 attenders had fewer but longer consultations per year; (c) an increase in follow-up intervals for current attenders with consultations remaining at 15 minutes each, and the recruitment of a further 1,856 diabetics in need of follow-up, each having one consultation every two years. The increase in the total annual costs of running the clinic for this option is less than 5 per cent.

Discussion

The implementation of appropriate clinical information systems allows the examination of the effects of clinical decisions on the use of resources in out-patient departments. In particular, areas in which resources can be reallocated can be identified, as the need to support new therapeutic advances or patient management schemes will predictably arise. This potential use of computer systems should be taken into account when considering the costs and benefits of implementation.

Clinical decision-making in the choice of follow-up intervals for different patients is often based on factors such as poor control which common-sense suggests should lead to more frequent follow-up. However, personal preferences play an important role; the 'doctor seen' is a strong predictor of the follow-up interval and there is a marked preference for six and 12 months. When

Table 3. Total patient costs per year and cost per patient per year for alternative options with increased length of follow-up. F—fixed costs; A—cost per attendance; P—cost per patient per year.

Increase in follow-up interval(%)	Option	Annual total cost equation	Annual total cost(£)	Annual cost per patient(£)
0	Current option	F + 3987A + 2226P	95156	43
30	Increased length of consultation	F + 3070A + 2226P	80392	36
30	Increased number of attenders	F + 3987A + 4082P	98887	24

information from the medical records was used as the basis for decision-making there was considerable variation in the choice of follow-up intervals. This was largely eliminated by a group discussion of each patient's needs and criteria for follow-up.

There are clear arguments for the development of protocols of care[11] based on consensus about the criteria for follow-up of patients who need continuing surveillance. They would provide a better framework for continuing evaluation, through routine patient contacts, of the effect of the duration of follow-up intervals on the long-term outcome of medical care. Equally important is the need for an assessment of the role of the diabetic clinic in the provision of care to diabetics within a health district.

Few clinics have been able to adopt a population approach to the provision of services, mainly because of organisational problems and the apparent demand for scarce out-patient clinic resources that this creates. Various studies[7] suggest that 45–54 per cent of diabetics do not currently attend any out-patient clinic for their diabetes; few of these are likely to have had a fundal examination within the last two years. Our own experience suggests that few GPs feel confident of performing a fundal examination, but, by lengthening the follow-up intervals of patients already attending the clinic, screening for diabetic retinopathy for the complete population at risk could be achieved with existing resources. The long-term benefits and savings of this change in resource use are considerable. On the other hand, out-patient clinics provide an expensive form of care. For example, in a comparison of the follow-up of patients with thyroid disease[12], the estimated cost of a visit to the GP was less than 50 per cent of an out-patient attendance. Travel and time costs incurred by the patients may create hardship and we believe they are sometimes an important factor in instances where clinic follow-up is discontinued. The ways in which patients are now referred to and retained by diabetic clinics sometimes indicate the lack of a coherent role for the clinic in diabetic care.

More work needs to be done on devising protocols of care for diabetes which provide guidelines on the frequency and most appropriate place for follow-up examinations. This will in turn demand good quality data that can be used to measure the cost and outcome of different policies for adjusting the balance of care between hospital and general practice.

Summary

One of the main determinants of cost in the follow-up of patients with chronic disease is the frequency with which they are seen in out-patient clinics. The implementation of clinical information systems allows this relationship to be investigated and rationalised. Such potential uses of clinical information systems should be considered when evaluating the costs and benefits of implementation.

In 2,226 diabetic clinic attenders, of ten variables studied, the doctor seen was one of the most consistent significant predictors ($P < 0.001$) of follow-up intervals and many patients were seen more often than was probably necessary. An increase of 30 per cent in all follow-up intervals would be clinically acceptable and would allow nearly 2,000 known non-attenders to be given a biannual examination. The increase in total annual costs would probably be less than 5 per cent.

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