

Identifying predictors of high quality care in English general practice: observational study

S M Campbell, M Hann, J Hacker, C Burns, D Oliver, A Thapar, N Mead, D Gelb Safran, M O Roland

Abstract

Objectives To assess variation in the quality of care in general practice and identify factors associated with high quality care.

Design Observational study.

Setting Stratified random sample of 60 general practices in six areas of England.

Outcome measures Quality of management of chronic disease (angina, asthma in adults, and type 2 diabetes) and preventive care (rates of uptake for immunisation and cervical smear), access to care, continuity of care, and interpersonal care (general practice assessment survey). Multiple logistic regression with multilevel modelling was used to relate each of the outcome variables to practice size, routine booking interval for consultations, socioeconomic deprivation, and team climate.

Results Quality of clinical care varied substantially, and access to care, continuity of care, and interpersonal care varied moderately. Scores for asthma, diabetes, and angina were 67%, 21%, and 17% higher in practices with 10 minute booking intervals for consultations compared with practices with five minute booking intervals. Diabetes care was better in larger practices and in practices where staff reported better team climate. Access to care was better in small practices. Preventive care was worse in practices located in socioeconomically deprived areas. Scores for satisfaction, continuity of care, and access to care were higher in practices where staff reported better team climate.

Conclusions Longer consultation times are essential for providing high quality clinical care. Good teamworking is a key part of providing high quality care across a range of areas and may need specific support if quality of care is to be improved. Additional support is needed to provide preventive care to deprived populations. No single type of practice has a monopoly on high quality care: different types of practice may have different strengths.

Introduction

Quality of care varies in most settings in which it has been studied, including in the United States,¹⁻³ the United Kingdom,⁴⁻⁸ New Zealand,⁹⁻¹⁰ Australia,¹¹⁻¹² and Holland,¹³ and medical errors are a cause of increasing

concern.¹⁴ In the United Kingdom the government has proposed a range of strategies for improving quality in the NHS.¹⁵⁻¹⁷ To respond appropriately to such initiatives it is necessary to understand both the extent of variation in quality of care and its causes, and several authors have examined these relations.¹⁸⁻²⁴ However, data on quality of care are not widely available in the United Kingdom, especially in primary care. Researchers rely largely on information collected from volunteer practices or on the small amount of routinely available data. In a systematic review of quality of care in general practice,⁴ we found that many studies focus on only one clinical area, precluding comparison of factors affecting different aspects of quality of care.

Quality of care is a multidimensional concept,²⁵ and different aspects of quality need different methods of measurement.²⁶ In this study we used a range of methods to carry out detailed assessments of quality of care in a stratified random sample of practices. The study represents the most comprehensive evaluation of quality of care in general practice in the United Kingdom to date. We have previously defined the components of quality of care as a combination of access (whether patients can get to health care) and the effectiveness of clinical care and interpersonal care (whether care is any good when they get there).²⁵⁻²⁷ Our results are presented within this framework. The aims of the study were to assess the extent of variation in quality of care in English general practice and to identify factors associated with high quality care.

Methods

Selection of practices

We used a three stage process to select practices. We selected three out of the eight English NHS regions—North Thames, North West, and South West—as being nationally representative in terms of rurality, socioeconomic deprivation, and geographical dispersion of population. From each of these three regions we selected two health authorities as being representative of their region in terms of rurality and socioeconomic deprivation. The six health authorities selected were Bury and Rochdale, West Pennine, Enfield and Haringay, South Essex, Avon, and Somerset. Finally, within each of these six authorities we selected a random sample of 10 practices stratified in

National Primary Care Research and Development Centre, University of Manchester, Manchester M13 9PL

S M Campbell
research fellow

M Hann
research associate

J Hacker
researcher

C Burns
researcher

D Oliver
researcher

N Mead
research associate

M O Roland
director

Department of General Practice, University of Manchester, Rusholme Health Centre, Manchester M14 5NP

A Thapar
general practitioner

The Health Institute, New England Medical Center, Boston, MA 02111, USA
D Gelb Safran
director

Correspondence to: S M Campbell
stephen.campbell@man.ac.uk

BMJ 2001;323:1-6

terms of practice size, training status, and socioeconomic deprivation. These 60 practices were invited to take part in a detailed assessment of quality. When a practice refused to participate, another with similar characteristics was chosen at random and invited to participate; 60 out of 75 (80%) practices that we approached agreed to take part.

Outcome measures

Quality of clinical care: chronic disease management—We used computerised disease registers or prescribing records to select 20 patients in each practice receiving maintenance treatment for each of three conditions: asthma in adults, angina, and type 2 diabetes mellitus. Some small practices had fewer than 20 patients with diabetes and angina. After confirming the relevant diagnosis from the medical records, we extracted data from medical records to identify aspects of care previously defined by expert panels as being both necessary to undertake and necessary to record for these conditions.²⁸ We measured the inter-rater reliability for all items and rejected those for which the κ value was <0.6 or which applied to $<1\%$ of the relevant sample. The box lists criteria used in the analyses.

Quality of clinical care: preventive care—For each practice we sent a questionnaire to the appropriate health authority to collect information on rates of uptake for cervical cytology screening; primary childhood immunisation; measles, mumps, and rubella immunisation; and preschool vaccination.

Patient evaluation: access and interpersonal care—We randomly selected 200 adults from each practice list and sent each patient a copy of the general practice assessment survey.^{30–31} Patients in five out of the six health authority areas received two postal reminders. We used data from these questionnaires to assess the quality of access, continuity of care, and interpersonal aspects of care.

Team climate and team effectiveness—Because of the importance now ascribed to teamwork in general practice, we sent the team climate inventory to all staff employed by the practices³²; 48 (80%) practices took part in this assessment. In line with previous applications of this method and on the recommendation of the questionnaire's main developer (M West, personal communication, 2000), we excluded from the analyses any practices where less than 30% of the staff completed questionnaires. The analyses included data from 42 (70%) practices, representing 387 (60%) members of staff. The team climate inventory assesses

perceptions of staff members of how people work together, how frequently they interact, whether teams have identified aims and objectives, and how much practical support and assistance are given towards new and improved ways of doing things. For the analyses reported in this paper we combined the team climate subscales into a single score.

Data analysis

For each criterion for angina, asthma, and diabetes we recorded whether the necessary aspect of care was recorded. We analysed these binary variables with an item response model within a multilevel framework (items within patients) by using GLLAMM-6 within Stata version 6.³³ For each condition, we calculated a score for each practice by using a random intercept constant only multilevel model (patients within practices). This is equivalent to calculating a mean score for each practice but adjusting for different pools of patients in different practices and the fact that many items were conditional variables that did not apply to all patients (for example, action to be taken if cholesterol exceeded a certain value). Only items that were applicable for individual patients were included in the score for the practice. Higher clinical scores (maximum=100) therefore reflected better clinical care measured with evidence based process measures.

We then used the scores for angina, asthma, diabetes, preventive care, access, continuity, and interpersonal care as dependent variables in a series of backwards stepwise regression models to identify predictors of high quality care. Clinical scores at the level of the patient were analysed with a multilevel model to account for the potential of clustering within practices. We analysed the scores from the survey of patients within a survey framework to allow for clustering, by using an ordered logistic regression model. We analysed the indicators for preventive care by looking at the achievement of higher target rates (90% for immunisations, 80% for cervical cytology) with logistic regression. All analyses were undertaken with Stata.

We regressed a common set of independent variables on each dependent variable. These independent variables were practice size (based on whole time equivalent general practitioners), routine booking interval for consultations (5 minutes, 7.5 minutes, 10 minutes), overall team climate, and deprivation score. We derived the deprivation score for each practice by using NHS deprivation bands, calculating the weighted sum of patients in each band (with census based deprivation payments as weights) divided by total list size. We included the training status of the practice in early analyses, but we subsequently excluded this as it was not a significant predictor of any of the outcomes.

Results

Quality of clinical care: chronic disease management

Variation in quality of chronic disease management—Data were collected in all 60 practices. Table 1 summarises practice scores for these and other variables. The practice scores for asthma, angina, and diabetes were significantly, but only moderately, correlated (angina v asthma $r=0.43$, $P<0.001$; angina v diabetes $r=0.32$, $P<0.001$; asthma v diabetes $r=0.55$, $P<0.001$).

Table 1 Variations in quality of care: summary clinical, access, and interpersonal scores (maximum=100)

Dependent variable	Mean score	Standard deviation	Range	Intraclass correlation coefficient
Angina	55.0	6.74	41-67	0.14
Asthma	50.1	12.33	25-73	0.30
Type 2 diabetes	62.1	11.84	33-83	0.37
Access	60.7	9.21	44-79	0.079
Continuity of care	66.5	11.07	42-87	0.081
Treatment by receptionists	68.2	9.19	45-85	0.057
Communication	72.0	6.34	60-88	0.025
Interpersonal care	69.2	6.84	50-83	0.030
Doctor's knowledge of patient	59.1	7.10	43-76	0.028
Nursing care	75.8	7.71	48-88	0.015
Overall satisfaction	74.7	5.93	59-88	0.022

Items used in the clinical scores

These criteria were devised by panels consisting largely of general practitioners with a special interest in the three areas, who used a systematic process to combine evidence with expert opinion.²⁸ Italics indicate conditional variables that do not apply to all patients.

Angina

Past 14 months, record of:

- Blood pressure
- Frequency or pattern of angina attacks
- Exercise capacity
- Prescription or advice to take aspirin unless record of contraindication or intolerance
- Prescription of β blocker as maintenance treatment if sole therapy
- Action taken on blood pressure if systolic pressure > 160 mm Hg, or systolic pressure > 140 mm Hg and cholesterol > 5.5 mmol/l

Past five years, record of:

- Cholesterol concentration
- Smoking status
- Diet therapy
- Action taken if cholesterol > 5.5 mmol/l
- Weight advice if overweight
- Smoking advice to smokers

Ever recorded:

- Referral for exercise electrocardiography
- Referral for specialist assessment

Asthma

Past 14 months, record of:

- Daily, nocturnal, or activity limiting symptoms

Past five years, record of:

- Smoking status
- Normal or predicted peak flow or record of difficulty using a peak flow meter
- Inhaler technique
- Self management plan for patients taking high dose steroids or who have had inpatient treatment for asthma
- For patients with recorded exercise induced bronchospasm, prescription of short acting bronchodilators for use before exercise
- Smoking advice to smokers
- Peak flow during a consultation for an exacerbation of asthma
- Speech rate, pulse rate, or respiratory rate during a consultation for an exacerbation of asthma if bronchodilator was used immediately
- Prescription of oral steroids if peak flow $< 60\%$ of normal or predicted
- Action taken if patient experienced nocturnal symptoms
- Action taken if patient experienced symptoms limiting activity
- Referral to a respiratory physician if oral steroids used in maintenance treatment

Type 2 diabetes mellitus

(Criteria developed before publication of United Kingdom prospective diabetes study²⁹)

Past 14 months, record of:

- Glycated haemoglobin (HbA_{1c})
- Recording of peripheral pulses or record of visual examination of the feet
- Serum creatinine concentration
- Proteinuria
- Examination of fundi or visual acuity
- Weight
- Blood pressure
- Record of hypoglycaemia symptoms if patient taking sulphonylurea

Past five years, record of:

- Serum cholesterol concentration
- Documentation of education about diabetes
- Smoking status
- Advice given to smokers

Blood pressure:

- Under 80 years—offered treatment if average of last three readings shows diastolic pressure > 100 mm Hg, or systolic pressure > 150 mm Hg and diastolic pressure > 90 mm Hg
- Over 80 years—offered treatment if average of last three readings shows diastolic pressure > 110 mm Hg, or systolic pressure > 160 mm Hg and diastolic pressure > 100 mm Hg

Treatment:

- If patient was prescribed angiotensin converting enzyme inhibitor, creatinine and potassium were measured within one month of starting treatment
- If patient is being treated for hypertension and has proteinuria (macroalbuminuria but not microalbuminuria), the patient is taking an angiotensin converting enzyme inhibitor
- For patients aged under 70, if the last HbA_{1c} was > 9 , patient offered a therapeutic intervention aimed at improving glycaemic control
- For patients aged over 70, if the last HbA_{1c} was > 10 , patient offered a therapeutic intervention aimed at improving glycaemic control
- Referral to a specialist if serum creatinine is > 200 mmol/l

Predictors of quality of chronic disease management— booking intervals, practices with 10 minute booking
Compared with practices with five minute consultation intervals had higher scores for all three chronic

Table 2 Mean unadjusted clinical scores (maximum=100) by routine booking interval for consultations

Routine booking interval	Angina	Asthma	Type 2 diabetes
5 minutes	48.5	32.2	55.1
5.1-9.9 minutes	54.7	46.4	58.0
≥10 minutes	58.7	53.8	64.6

Table 3 Variations in quality of care: summary of scores for prevention

Preventive care indicator	No (%) of practices
Primary childhood immunisation: target achieved (90%)	44/49 (90)
MMR vaccine at 13 months: target achieved (90%)	27/44 (61)
Child preschool booster (excluding MMR): target achieved (90%)	35/48 (73)
Preschool MMR booster: target achieved (90%)	22/42 (52)
Uptake of cervical cytology: target achieved (80%)	44/49 (74)

MMR=measles, mumps, and rubella.

diseases (table 2). Adjusted mean scores in practices with routine 10 minute booking intervals were 10.0 points higher for diabetes (95% confidence interval 1.06 to 18.95, $P=0.028$), 10.2 points higher for angina (3.83 to 16.58, $P=0.002$), and 21.6 points higher for asthma (12.30 to 30.91, $P<0.001$) than in practices with five minute intervals. For diabetes, two other variables were significantly associated with differences in quality of care. Larger practices had higher scores for diabetes than did smaller practices (adjusted difference 2.16 (0.22 to 4.10), $P=0.029$), as did practices where staff reported better team climate (2.37 (0.36 to 4.38), $P=0.021$).

Quality of clinical care: preventive care

Complete data for all five indicators were available for 42 (70%) practices. Table 3 shows summary statistics for the preventive care indicators. Practices in deprived areas had lower uptake rates for cervical cytology—odds ratio 0.65 (0.48 to 0.89, $P=0.008$). Preventive care and other practice variables showed no significant independent associations.

Access and interpersonal aspects of care

Copies of the general practice assessment survey were sent to 11 831 patients, and 4493 (38%) were returned after, for most practices, two reminders. We compared the results with those of studies with response rates of between 60% and 90% (other published data,³⁴ and data held by the National Primary Care Research and Development Centre) and found that the mean and median survey scores and relations between scale scores and sociodemographic factors were similar to ours. We therefore decided to include the survey data in our analyses despite the low response rate, although these results, which are summarised in table 1, should be treated with considerable caution because of the low response rate.

Smaller practices had higher scores for access (adjusted odds ratio 0.87 (0.76 to 0.99), $P=0.038$), as did practices where the staff reported better team climate (1.23 (1.09 to 1.38), $P=0.001$). Practices with higher scores for team climate also had higher scores for continuity of care (1.33 (1.18 to 1.50), $P<0.001$).

Small practices had higher scores on the receptionist scale (0.82 (0.74 to 0.90), $P<0.001$), as did practices with fewer deprived patients (0.88 (0.83 to 0.94),

$P<0.001$). More deprived practices had lower scores for interpersonal care (0.92 (0.86 to 0.98), $P=0.015$) and overall satisfaction (0.90 (0.82 to 0.98), $P=0.019$). Practices where the staff reported better team climate also had higher scores for satisfaction (1.11 (1.05 to 1.19), $P<0.001$).

Discussion

The findings of this study confirm that English general practice varies widely in quality of care, as measured from a range of perspectives. Most studies assess quality of care from a single perspective or for a single condition. Our findings highlight the importance of assessing quality of care with a range of measures, as each approach illuminates different aspects of quality of care.

Predictors of quality of care

Four variables stood out as predictors of quality of care. The largest effect was the relation between the booking interval for routine consultations and the quality of management of chronic disease. Other authors have emphasised the importance of adequate time for consultations.²³ The effect was greater for asthma than for diabetes and angina, possibly because the last two conditions are more likely to be treated in separate clinics than in routine surgeries. These data provide strong support for the view that general practice should be structured to allow time for the increasing complexity of the work required of general practitioners.

Secondly, we found significant associations between size of practice and quality of care, as has been seen in other studies,^{19 24} although the relation was not simple. Smaller practices scored better than larger ones for access to care, but for diabetes care larger practices had higher scores than smaller ones. This emphasises that no single type of practice has a monopoly on high quality care—different types of practice may have different strengths. This is an important finding at a time when small practices in the United Kingdom are coming under particularly close scrutiny from the government.³⁵ As others have found, there may be a trade-off between high quality clinical care and interpersonal care.³⁶

Thirdly, deprivation predicted poorer uptake of preventive care, highlighting that quality of care in general practice is influenced by environmental factors.^{18 37} Preventive care is one area in which patients' actions influence the quality of care that can be provided. In other areas where practices had the main control, no significant associations between deprivation and quality of care were found.

Finally, team climate was associated with quality of care for diabetes care, access to care, continuity of care, and overall satisfaction. This was the only variable that was associated with high quality care across a range of aspects of care. The associations are not necessarily causal: it is possible, for example, that staff felt better in practices where good care was given because they received fewer complaints from patients. However, the measure of team climate is intended to reflect how people actually work together and how much support is given towards maintaining high standards of care. High quality care in general practice needs effective teamwork, and this is emphasised in the awards of the

What is already known on this topic

Quality of care varies in virtually all aspects of medicine that have been studied

Most studies look at quality of care from a single perspective or for a single condition

What this study adds

Quality of care varies for both clinical care and assessments by patients of access and interpersonal care

Practices with longer booking intervals provide better management of chronic disease; preventive care is less good in practices in deprived areas

No single type of practice has a monopoly on high quality care—small practices provide better access but poorer diabetes care

Good team climate reported by staff is associated with a range of aspects of high quality care

Royal College of General Practitioners, which assess the performance of practice teams rather than individuals.

Limitations of the study

Although this is one of the most comprehensive surveys of quality of care in British general practice, the study looked at only limited aspects of overall quality. For example, the clinical data represented only three chronic conditions, a small part of the clinical work undertaken in general practice. Ongoing work by three of the authors (SC, MR, JH) has developed, and is currently field testing, clinical indicators for 19 common conditions presenting in general practice in the United Kingdom.³⁸

The clinical scores were derived from information available only from medical records. Although the expert panels that derived the review criteria selected only aspects of care that they believed needed to be recorded,²⁸ a considerable gap may still exist between what doctors do and what they record. For example, medical records have been found to underestimate preventive or counselling activities.³⁹ Although there is evidence from the United States that quality of record keeping is positively correlated with quality of care,^{40–41} similar analyses have not been carried out in the United Kingdom.

The analytical approach and framework (access and effectiveness) used in this study were experimental. Other workers studying the same phenomena using a different approach may not reproduce the findings from this research. Despite the limitations of the methods used and the low response rate of the survey of patients, which mean that the scores for access and interpersonal care should be treated with some caution, this study confirms that wide variation in the quality of care exists in English general practice. The study also identifies important predictors of high quality care that need to be considered as general practice is restructured to meet the needs of the 21st century.

We thank the staff in all 60 practices and six health authorities who took part in the study, and Emma Ruff and Andrew Pickles for their contribution to the project.

Contributors: The project was devised by SC and MR and managed by SC. Data were collected by SC, JH, and CB, with the assistance of AT, NM, and DO. The general practice assessment survey was developed by MR, DGS, CB, and SC. SC and MH undertook the analyses. SC, MR, and MH wrote the paper, with SC as the principal author. SC is the guarantor of the paper.

Funding: National Primary Care Research and Development Centre core funding from the Department of Health.

Competing interests: None declared.

- 1 Chassin MR, Galvin RW, National Roundtable on Health Care Quality. The urgent need to improve health quality. *JAMA* 1998;280:1000-5.
- 2 Shuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States. *Milbank Quarterly* 1999;76:517-63.
- 3 Weingart SN, Wilson RM, Gibberd RW, Harrison B. Epidemiology of medical error. *BMJ* 2000;320:774-7.
- 4 Seddon ME, Marshall MN, Campbell SM, Roland MO. Systematic review of studies of clinical care in general practice in the United Kingdom, Australia and New Zealand. *Qual Health Care* 2001;10:152-8.
- 5 Feder G, Griffiths C, Highton C, Eldridge S, Spence M, Southgate L. Do clinical guidelines introduced with practice based education improve care of asthmatic and diabetic patients? A randomised controlled trial in general practices in east London. *BMJ* 1995;311:1473-8.
- 6 Dunn NR, Bough P. Standards of care of diabetic patients in a typical English community. *Br J Gen Pract* 1996;46:401-5.
- 7 Campbell NC, Thain J, Deans HG, Ritchie LD, Rawles JM. Secondary prevention in coronary heart disease: baseline survey of provision in general practice. *BMJ* 1998;316:1430-4.
- 8 Khunti K, Baker R, Rumsey M, Lakhani M. Quality of care of patients with diabetes: collation of data from multi-practice audits of diabetes in primary care. *Fam Pract* 1999;16:54-9.
- 9 Corwin P, Munn E, Nicholls D. A study of general practitioners' skin surgery in Canterbury. *N Z Med J* 1997;110:253-5.
- 10 Kendall D, Lunt H, Moore MP, McSweeney WP. Diabetes complication screening in general practice: a two pass audit with benchmarking. *N Z Med J* 1999;112:141-4.
- 11 Lathlean S. Skin cancer in general practice in South Australia. A five year study. *Aust Fam Physician* 1999;28(suppl 1):S28-31.
- 12 Collins S, Beilby J, Fardy J, Burgess T, Johns R, Booth B. The national asthma audit. Bridging the gap between guidelines and practice. *Aust Fam Physician* 1998;27:907-13.
- 13 Van Drenth BB, Hulscher MEJL, Mokkink HGA, van Weel C, Grol RPTM. Relationship between practice organization and cardiovascular risk factor recording in general practice. *Br J Gen Pract* 1998;48:1054-8.
- 14 Leape LL, Berwick DM. Safe health care: are we up to it? *BMJ* 2000;320:725-6.
- 15 Department of Health. *A first class service: quality in the new NHS*. London: Stationery Office, 1998.
- 16 Department of Health. *An organisation with a memory*. London: Stationery Office, 1999.
- 17 Department of Health. *Supporting doctors, protecting patients: a consultation paper on preventing, recognising and dealing with poor clinical performance of doctors in the NHS in England*. London: Stationery Office, 1999.
- 18 Baker D, Klein R. Explaining outputs of primary care: population and practice factors. *BMJ* 1991;303:225-9.
- 19 Baker R. General practice in Gloucestershire, Avon and Somerset: explaining variation in standards. *Br J Gen Pract* 1992;42:415-8.
- 20 Ram P, Grol R, Van den Hombergh P, Rethans JJ, Van der Vleuten C, Aretz K. Structure and process: the relationship between practice management and actual clinical performance in general practice. *Fam Pract* 1998;15:354-62.
- 21 Norton PG, Dunn EV, Soberman L. What factors affect quality of care? Using the peer assessment program in Ontario family practices. *Can Fam Physician* 1997;43:1739-44.
- 22 Howie JGR, Heaney DJ, Maxwell M, Walker JJ, Freeman GK. Developing a 'consultation quality index' (CQI) for use in general practice. *Fam Pract* 2000;17:455-61.
- 23 Howie JG, Heaney DJ, Maxwell M. *Measuring quality in general practice. Pilot study of a needs, process and outcome measure*. London: Royal College of General Practitioners, 1997. (Occasional paper 75)
- 24 Khunti K. Use of multiple methods to determine factors affecting quality of care for patients with diabetes. *Fam Pract* 1999;16:489-94.
- 25 Campbell SM, Roland MO, Buetow S. Defining quality of care. *Soc Sci Med* 2000;51:1611-25.
- 26 Blumenthal D. Quality of care—what is it? *N Eng J Med* 1996;335:891-4.
- 27 Roland MO. Quality and efficiency: enemies or partners? *Br J Gen Pract* 1999;49:140-3.
- 28 Campbell SM, Roland MO, Shekelle PG, Cantrill JA, Buetow SA, Cragg DK. The development of review criteria for assessing the quality of management of stable angina, adult asthma and non insulin dependent diabetes mellitus in general practice. *Qual Health Care* 1999;8:6-15.
- 29 Adler AI, Stratton IM, Neil HA, Yudkin JS, Matthews DR, Cull CA, et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *BMJ* 2000;32:412-9.
- 30 Roland MO, Holden J, Campbell SM. *Quality assessment for general practice: supporting clinical governance in primary care groups*. Manchester: National Primary Care Research and Development Centre, 1998.

- 31 Ramsay J, Campbell JL, Schroter S, Green J, Roland M. The general practice assessment survey (GPAS): tests of data quality and measurement properties. *Fam Pract* 2000;17:372-9.
- 32 Poulton B, West M. The determinants of effectiveness in primary health care teams. *J Interprofessional Care* 1999;13:7-18.
- 33 Rab-Hesketh S, Pickles A, Taylor C. Generalised-linear latent and mixed models. *STATA Technical Bulletin* 2000;53:44-57.
- 34 Campbell JL, Ramsay J, Green J. Age, gender, socio-economic and ethnic differences in patients' assessments of primary health care. *Qual Health Care* 2001;10:90-5.
- 35 Department of Health. *The NHS plan: a plan for investment, a plan for reform*. London: Stationery Office, 2000. (cm4181-L)
- 36 Kimmonth AL, Woodcock A, Griffin S, Spiegel N, Campbell ML. Randomised controlled trial of patient centred care of diabetes in general practice: impact on current wellbeing and future disease risk. *BMJ* 1998;317:1202-8.
- 37 Heath I. *The mystery of general practice*. London: The Nuffield Provincial Hospitals Trust, 1995. (John Fry Trust Fellowship)
- 38 Marshall M, Campbell S, Hacker J, Roland M, eds. *Assessing the quality of clinical care in general practice: a practical guide to clinical quality indicators for primary care health professionals and managers*. London: Royal Society of Medicine (in press).
- 39 Luck J, Peabody JW, Dresselhaus TR, Lee M, Glassman P. How well does chart data abstraction measure quality? A prospective comparison of standardized patients with the medical record. *Am J Med* 2000;108:642-9.
- 40 Solomon DH, Schaffer JL, Katz JN, Horsky J, Burdick E, Nadler E, et al. Can history and physical examination be used as markers of quality? An analysis of the initial visit note in musculoskeletal care. *Med Care* 2000;38:383-91.
- 41 Kosecoff J, Fink A, Brook RH, Chassin MR. The appropriateness of using a medical procedure. Is information in the medical record valid? *Med Care* 1987;25:196-201.

(Accepted 3 August 2001)