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The impact of budgets for gatekeeping physicians on patient satisfaction: evidence from fundholding

Mark Dusheiko[*]   Hugh Gravelle[*]   Ning Yu[+]

Abstract

The most controversial part of the UK internal market reforms was the introduction of fundholding under which general practices held budgets for prescribing and elective secondary care for their patients. This paper examines the impact of the fundholding scheme on the overall satisfaction of patients with their practice as a summary of the effects of fundholding on patients. It uses a cross sectional survey of 4311 patients from 60 practices in the last year of fundholding (1998). Fundholding decreased patient satisfaction after controlling for observable patient and practice level characteristics and allowing for selection bias using instrumental variable methods. The negative effects of fundholding were not influenced by patient characteristics such as age, gender, ethnicity, health or income. Patients within first wave fundholders were less satisfied than other fundholder waves. The findings suggest that financial incentives and budgetary arrangements affect the strength of the patient agency role of doctors.

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1 Introduction

In health care systems where patients face very low or zero prices for care, the funders of the service can attempt to counter the resulting moral hazard problems by giving primary care doctors the role of gatekeepers whose assent is required for consumption of health care. Countries with such gatekeeping arrangements include the United Kingdom, Eire, the Scandinavian and Australasian countries. Many Health Maintenance Organisations in the US also have gatekeeping physicians (Glied, 2000). The gatekeeping function, however, does not in itself imply that the demand for care will be restrained by the primary care doctor who must balance the interests of their specific patients against the interests of the generality of taxpayers or premium payers. The professional ethos of doctors means that in the absence of any direct financial or other incentives they will place greater weight on the interests of the particular individual who could derive some benefit, even if small, from treatment.

Under the UK fundholding scheme, as part of the internal market reforms of the Thatcher government, general practices were given budgets to buy care for their patients. Although the scheme was highly controversial it has been subject to surprisingly little evaluation by economists. In this paper we examine the impact of the fundholding scheme on the overall satisfaction of patients with their practice, which we take as a summary measure of its effects on patients.

The fundholding practice budget was intended to be sufficient to purchase their original bundle of services for patients, so that they could have purchased a bundle which was at least as good for patients as the bundle before fundholding was introduced. Hence the effect on patient satisfaction also provides some evidence about the strength of the patient agency role of doctors.

1.1 The fundholding experiment

In the UK National Health Service (NHS) almost all care is provided free at the point of use.[1] NHS patients register with a primary care physician or general practitioner (GP). GPs undertake a wide range of services including initial diagnosis, prescription of drugs, management of chronic conditions, and minor surgery. They also act as gatekeepers since they are the only route by which NHS patients can access secondary care for diagnosis and non-emergency treatment. The vast majority of GPs are independent contractors with considerable flexibility in the services they provide. Their income is primarily determined by the size of their patient list.

In 1991 the UK government introduced a split between purchasers and providers of health care in the NHS (Department of Health, 1989). NHS hospitals were removed from the direct control of Health Authorities (HAs). HAs became purchasers of health care from a fixed budget determined by a needs weighted capitation formula. At the time of our study (1998) the average HA contained around 100 general practices and had a population of about 500,000. NHS hospitals remained within the public sector but were required to compete for contracts from purchasers in what was known as the NHS internal market.

As part of the 1991 reforms, larger general practices could volunteer to become fundholders (Glennerster et al., 1994). Fundholding practices were given an annual budget by their Health Authority to purchase a range of community health services and elective hospital procedures and to cover their prescribing. Budgets were intended to be sufficient to buy the bundle of services which the practice's patients had previously consumed before the practice became a fundholder. Fundholding practices could retain any budget surplus to spend on additional services to patients or to improve facilities in their practice. Practices that remained outside the fundholding scheme continued to have expenditure on their patients covered by their HA from its budget.

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[1] Patients pay for drugs dispensed in primary care but over 85% of such drugs are dispensed without charge because of exemptions for children, the elderly, chronic sick and those on low income.

After a change of government in 1997, no new fundholders were allowed from April 1998 and fundholding was abolished in April 1999. At the time of abolition, around 50% of GP practices had elected to join the fundholding scheme.

1.2 Effects of fundholding

The fundholding scheme created an incentive for GPs to reduce expenditure on services covered by the scheme to achieve savings that could be used at the discretion of GPs. Compared with non-fundholding practices, GP fundholders appear to have secured a relatively slower growth in pharmaceutical costs (Goodwin, 1998). Fundholding also led to lower admission rates for elective procedures (Gravelle et al., 2002; Dusheiko et al., 2003b).

Fundholding gave the GP leverage over hospitals, enabling them to switch to an alternative provider with a better combination of quality, price, and waiting time. Patients of GP fundholders appear to have had shorter waiting times for hospital treatment compared with patients of non-fundholders (Goodwin, 1998; Dowling, 2000; Propper et al., 2002; Dusheiko et al., 2003a).

Fundholding practices were required to use their budget savings to improve services to their patients. There is some evidence indicating that fundholders may have increased the number of in practice-level services to patients with the development of practices based services for physiotherapy, dietetics, chiropody, psychiatric nursing, and psychology (Goodwin, 1998). Although savings could not be directly appropriated by GPs as personal income, they could be used to improve the practice's premises, thus yielding capital gains when premises were sold. Thus fundholding GPs could channel savings to uses which also benefited themselves as well as patients.

The effects of fundholding on patients varied across patients. Patients who were denied elective admissions and drug prescriptions were worse off under fundholding unless they would otherwise have received ineffective or harmful treatment. Those patients who did receive treatment appear to have received a better quality of care in terms of lower waiting times. Other patients would have gained from provision of

additional clinics or services for patients with particular conditions and all patients would have benefited from improved premises. On the other hand, additional administrative and time costs of fundholding may have diverted GP effort away from direct patient care.

If GPs were perfect agents for their patients they would not have switched to fundholding if this would have made their patients worse off. Doctors would be unusual in displaying such a degree of altruism. Perfect agents will not change their patient care in response to financial incentives which have no direct effect on the marginal benefits and costs to patients of that care. GPs' responses to, for example the changes in fees by the NHS for particular items of service in the 1990 GP contract (Giuffrida and Gravelle et al, 2001), suggest that they are at best incomplete altruists, willing to trade off patient welfare for increased income.

Under the capitation system GP income varies positively with the number of patients. They can compete for patients only via the range and quality of services they provide. Such competition is weakened by the costs of search and switching, distance costs and the fact that general practice is at least partially an experience good (Gravelle, 1999; Gravelle and Masiero, 2000). Hence it is not clear *a priori* that either competition or altruism will lead fundholding practices to choose a mix of services which makes their patients better off than they were before the practice became a fundholder.

In order to evaluate the overall effects of the changes induced by fundholding a measure of patient welfare is required. One possibility is to use patients' reports of their satisfaction with their GP. Satisfaction is an outcome of interest in its own right, and is also a useful summary measure of many dimensions of health care observed by the patient (Carlsen and Grytten, 2000). Our main research question is therefore the impact of fundholding status on the overall level of patient satisfaction. But fundholding led to changes in a number of aspects of care with potentially differential effects on different types of patient. Hence we also investigate whether the effects of fundholding on patient satisfaction differed according to the age, gender, ethnicity, health, income, or employment status of patients.

1.3 Literature review

We were able to find only four studies of the impact of GP fundholding on patient satisfaction. Corney (1999) surveyed patients in the South East Thames region before and after the introduction of fundholding. The 180 patients from eight practices (four which became second-wave fundholders in 1993 and four which remained non-fundholders) were surveyed in 1992 and then again in 1994. Patient satisfaction was high in both periods and there was no significant change for patients in practices which became fundholders relative to those which did not. There was little willingness of patients to change practices and no difference in this respect between the patients of fundholders and non-fundholders.

Sargeant and Kaehler (1998) interviewed 182 randomly selected individuals, 21 belonging to fundholding practices, in a shopping centre in the south west of England in 1996. Respondents were not asked about the fundholding status of their practice to avoid potential bias; instead they were asked which practice they belonged to. Respondents were generally quite satisfied with the quality of the service from their GP, and fundholding patients were more satisfied than non-fundholding patients.

Howie, Heaney and Maxwell (1995) surveyed a total of 2329 patients in six Scottish practices in 1990 and another 2005 in 1992 after the practices had become fundholders. They focussed on patients who had particular health problems and used a measure of patient satisfaction/enablement - the extent to which patients feel that the practice enables them to look after themselves when coping with health problems. There was a significant decrease in satisfaction/enablement scores for patients with pain, skin problems and digestive problems, as well as for patients in general, between 1990 and 1992. There was no change in consultation length after the practices became fundholders.

Kind, Leese, and Hardman (1993) surveyed patients in six practices (five of which were fundholders) in 1992. The majority of the 583 patients who responded were unaware of the fundholding status of their practice (75% of men, 80% of women). 42% of respondents in the non-fundholding practice rated its service as excellent, compared to 37% of patients in the fundholding practices.

The mixed results from these studies do not provide clear evidence of the effects of fundholding on patients and they suffer from a number of methodological difficulties. Three of the studies took place very early in the history of fundholding and all had a small number of practices and patients. The design and analytical methods in three of the four studies did not enable them to correct for potential selection bias: the possibility that practices which became fundholders were more likely to have better or worse services to patients irrespective of their fundholding status.

Our paper makes a number of contributions to the assessment of the effect of giving budgets to gatekeeping primary care doctors. We have data on a larger number of patients, in more practices, than previous studies. The data relate to 1998 when fundholding was well established, rather than to the period immediately after the fundholding scheme was introduced. We have much richer data on the characteristics of both individuals and their practices and so are better able to control for potential confounders. Finally, we attempt to allow for potential selection bias by instrumental variables methods.

2 Data

Our main data source is a survey of the patients of 60 English practices in the last year of fundholding (1998), to which we have linked several practice level data sets. The full set of variables used in the analysis is shown in Table 1.[2]

2.1 Patients

The General Practice Assessment Survey (GPAS) (*www.gpas.co.uk*) asks patients about their experience of using their general practice, their views on how satisfied they are with their overall care, as well as specific dimensions of care, such as its accessibility and quality. We used an augmented version of GPAS, with additional questions on income, employment status and various aspects of health along with demographic and other socio-economic characteristics. We used all the separate

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[2] The full variable definitions and sources are available from the authors on request.

dimensions of the SF-6D health indicator as measures of health status (Brazier et al., 2002). GPAS also asks patients about the number of years they have been registered with their practice, the number of GP visits they have made in the last year, and their views on the convenience of the location of the practice. The sample was selected by multistage stratification (Campbell et al., 2001).

2.2 Practice characteristics

Data on the characteristics of practices were obtained from a variety of sources. The fundholding status for each practice was derived from lookup tables from the Prescription Pricing Authority and the Organisational Codes Service of the Department of Health. Of the 60 practices, 25 were standard fundholders (with budgets for prescribing, elective hospital care, and community health services), 6 were community fundholders, and 29 held no budget. We lump all non-standard fundholders together as "non-fundholders", and thereby tend to underestimate the effect of fundholding on patient satisfaction. Table 8 shows the distribution of fundholding practices and patients by wave.

We had data on practice characteristics for 1998, derived from the Department of Health's General Medical Statistics and from the NPCRDC website (http://www.primary-care-db.org.uk/). They included GP age, sex, country of qualification, numbers of GPs, whether GPs were approved trainers, whether the practice offered different types of clinics (such as minor surgery), the proportion of rural patients, and whether the practice received payment for providing preventive care.

We also had practice level information relating to the socio-economic characteristics of the population. The main sources of socio-economic data were the 1991 Census and the components of the Index of Multiple Deprivation (DETR, 2000) which uses information on Social Security payments in 1998 and 1999. The data are available at small area (frozen 1998 electoral ward) level. As part of the AREA project (Sutton et al., 2002) they were attributed to practices by taking weighted averages based on the proportion of practice populations resident in each ward (from the Department of

Health's Attribution Data Set used to calculate the 2000/1 funding allocations to HAs). Some socio-economic data, such as the Low Income Scheme Index (the proportion of prescriptions from a practice which were dispensed without charge because the patient was exempt on grounds of low income), related directly to the practice.

From the QUASAR study of practice quality (Campbell, Hann, Hacker, Burns, Oliver, and Thapar, 2001) we had a number of practice level measures of the quality of patient care. These relate to the management of chronic disease (angina, asthma and diabetes), quality of preventive care, access, continuity, and organisation of care. We also used indicators of prescribing quality and cost produced by the Prescribing Support Unit (Campbell et al., 2000).

We also used aggregate waiting times data for patients belonging to our 60 practices from NHS Hospital Episodes Statistics (HES) (for details see (Dusheiko, Gravelle, and Jacobs, 2003a)).

2.3 Other health service provision

Since patients' views on their practices may be influenced by the availability of substitute and complementary health services we include measures of the supply of other types of service. We used data on supply factors from the AREA project (Sutton et al, 2002) including access measures for practice populations to NHS Trusts, private hospitals, residential and nursing homes and the numbers of beds and consultants at NHS Trusts.

3 Methods

All models were estimated with Stata SE 7.0 for Windows, and included Health Authority dummy variables in the regressions as fixed effects to capture, inter alia, any survey design effects. We also allowed for the clustering of errors within GP practices by using the *cluster* command which estimates Huber/White robust standard errors (Stata, 2001). The sample was not self-weighting because the probability of an

individual being selected depended on the size of the practice. We did not use sampling weights which are less efficient and no more unbiased in a regression model intending to determine the relationship between fundholding and satisfaction (Deaton, 1997).

3.1 Regression models

Patients of practices were asked to report their overall satisfaction with their practice: "All things considered, how **satisfied** are you with your practice" by ticking numbered boxes.[3] The dependent variable S_{ip} is thus ordered categorical with 7 categories ranked from lowest to highest satisfaction: 1 (Completely dissatisfied, could not be worse); 2 (Very dissatisfied); 3 (Somewhat dissatisfied); 4 (Neither satisfied nor dissatisfied); 5 (Somewhat satisfied); 6 (Very satisfied); 7 (Completely satisfied, could not be better). We denote the reported satisfaction as $S_{ip} = j$ ($j = 1,…,7$) if individual i in practice p reports satisfaction in category j.

We use three regression models to explore the effect of fundholding status on reported satisfaction.

3.1.1 Ordinary least squares

The linear regression model assumes that reported satisfaction categories are measured on an interval scale ranging from 1 to 7. Thus S_{ip} is assumed to be a cardinal measure, implying for instance that the gain in satisfaction from moving from being completely dissatisfied to very dissatisfied is the same as the gain in satisfaction from moving from being very satisfied to completely satisfied. The model is estimated by ordinary least squares regression of S_{ip} on the explanatory variables including fundholding status using the *regress* command.

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[3] The boxes on the questionnaire were ordered from "Completely satisfied" (box 1) to "Completely dissatisfied" (box 7). To make presentation of results more intuitive we have reordered the categories so that higher categories correspond to greater satisfaction.

3.1.2 Ordered regression model

Although the OLS model results are easy to interpret, for example in comparing mean satisfaction between fundholding and non-fundholding practices, it can produce misleading results (Long, 1997) . The ordered regression model (ORM) assumes that there is an unobservable latent satisfaction measure

$$S_{ip}^* = \delta F_p + \boldsymbol{\beta}_1' \mathbf{x}_{1ip} + \boldsymbol{\beta}_2' \mathbf{x}_{2p} + v_p + \varepsilon_{ip}', \tag{1}$$

where F_p is a dummy variable indicating the fundholding status of the practice, $\mathbf{x}_{1ip}$ is a vector of observable individual level covariates (such as patient age, gender, income, reported number of visits to the GP), and $\mathbf{x}_{2p}$ are observable practice level covariates (such as number of GPs in the practice). v_p is a practice level random error term, and ε_{ip}' an individual specific error term. We assume that both error terms have zero mean and are independently distributed. For notational convenience, we combine both error terms into $\varepsilon_{ip.}$

We assume, for the moment, that $\varepsilon_{ip.}$ is uncorrelated with the fundholding status of the practice, so that the coefficient on F_{ip} is the effect that fundholding would have on patient i in practice p irrespective of the actual fundholding status of practice p. In the jargon of the evaluation literature, δ is the average effect of treatment on the treated and our assumption implies that it is also the average effect of treatment (Heckman J et al., 1999).

The observed responses S_{ip} are generated from (1) by

$$\begin{aligned} S_{ip} &= 1 \Leftrightarrow S_{ip}^* \leq \alpha_1 \\ &= j \Leftrightarrow \alpha_{j-1} < S_{ip}^* \leq \alpha_j, \quad j = 2,...,6 \\ &= 7 \Leftrightarrow \alpha_6 < S_{ip}^* \end{aligned} \tag{2}$$

The probability that an individual reports satisfaction no greater than category j is[4]

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[4] The latent satisfaction model (1) may contain a constant term α but as only $\alpha_j - \alpha$ is identified by the estimation we set $\alpha = 0$.

$$\gamma_{ipj} = \Pr\left(S_{ip} \leq j \mid \mathbf{x}_{1ip}, \mathbf{x}_{2p}, F_p\right) = \Pr\left(S_{ip}^* \leq \alpha_j\right)$$
$$= \Pr\left(\varepsilon_{ip} \leq \alpha_j - \boldsymbol{\beta}_1'\mathbf{x}_{1ip} - \boldsymbol{\beta}_2'\mathbf{x}_{2p} - \delta F_p\right) \tag{3}$$

With a logistic distribution for the error term ε_{ip} the log of the odds of reporting a level of satisfaction no greater than category j is

$$\log\left\{\gamma_{ipj} / \left(1 - \gamma_{ipj}\right)\right\} = \alpha_j - \boldsymbol{\beta}_1'\mathbf{x}_{1ip} - \boldsymbol{\beta}_2'\mathbf{x}_{1p} - \delta F_p \tag{4}$$

A positive coefficient on a variable implies that it increases latent satisfaction and hence leads to a greater probability of reporting a higher category of satisfaction and reduces the log of the odds of reporting a level of satisfaction less than or equal to category j. We estimate the ordered logistic model using the *ologit* command.

3.1.3 Generalised ordered regression model

The ORM is analogous to estimating 6 binary satisfaction response models for the 6 possible dichotomies of responses to the satisfaction question: {1, 234567}; {12, 34567}, {123, 4567}, {1234, 567}, {12345, 67}, {123456, 7} with the restriction that the estimated slope coefficients from the binary regression equations are identical. The ORM implies that the distribution function for latent satisfaction is shifted horizontally parallel by the explanatory variables. The model also assumes that combining or adding response categories do not affect the coefficient estimates for $\boldsymbol{\beta}_1$, $\boldsymbol{\beta}_2$ and δ.

The generalised ordered regression model (GORM) allows the estimated coefficients on the explanatory variables to vary with the level of the response category thresholds α_j. With the logistic error distribution

$$\log\left\{\gamma_{ipj} / \left(1 - \gamma_{ipj}\right)\right\} = \alpha_j - \boldsymbol{\beta}_{1j}'\mathbf{x}_{1ip} - \boldsymbol{\beta}_{2j}'\mathbf{x}_{2p} - \delta_j F_p \tag{5}$$

Hence the effect of fundholding on the log of the odds of reporting a level of satisfaction less than or equal to category j will vary across categories

We estimate the general ordered logistic model with the *gologit* command (Fu, 1998). We test the parallel regression assumption using the *omodel* and *fitstat* commands

(Long and Freese, 1998; Wolfe and Gould, 1998) to compare the likelihood ratios from the general and restricted models.

3.2 Selection bias

We do not observe the same patients in the same practices at the same point in time under both fundholder and non-fundholder regimes. To identify the true impact of fundholding status on patient satisfaction we have to construct the counterfactual level of satisfaction from satisfaction outcomes for patients within fundholding and non-fundholding practices. GP fundholding was a voluntary scheme and patients could choose their practice. Hence a simple comparison of average levels of patient satisfaction between patients in fundholding and non-fundholding practices could be biased by selection of practices and patients. Part of any observed difference in patient satisfaction between fundholder and non-fundholder practices may have been present even if no practices had become fundholders.

There is evidence that fundholder practices and their populations were different from non-fundholding practices (Baines and Whynes, 1996). It is less clear that patients' choices of practice were affected by its fundholding status. Kind, Leese and Hardman (Kind et al., 1993) found that 75% of men and 80% of women in their sample were unaware of the fundholding status of their practice. Dixon et al. (1997) noted that around 2% of patients switch GP practice without a change of address and could find no evidence that fundholding status of the practice affected their choice. In our data-set, only 2.7% of patients have been registered with their GP practice for less than a year, and 83% have been registered with the same practice for at least four years. Thus if there is selection bias it is more likely to arise from practice choice of fundholding status than from patient choice of practice.

Practices choose fundholding status and then individuals choose amongst practices given their fundholding status. Practice decisions on fundholding status will be determined by observable and unobservable practice characteristics. The choice of practice by a patient will depend on her characteristics and the characteristics of all practices in her area. Since we do not have data on all practices in an area we model

the determination of whether an individual is in a fundholding practice, which reflects both patient and practice choices, by assuming that

$$F_{ip} = 0 \text{ (or 1)} \quad \Leftrightarrow \quad F_{ip}^* = \boldsymbol{\pi}_1' \mathbf{w}_{1ip} + \boldsymbol{\pi}_2' \mathbf{w}_{2ip} + \alpha_p + \upsilon_{ip}' < 0 \text{ (or} \geq 0) \tag{6}$$

where F_{ip}^* is an unobservable latent index. $\mathbf{w}_{1ip}$ is a vector of individual specific covariates influencing whether individual i belongs to a fundholding practice or not. $\mathbf{w}_{2p}$ a vector of practice specific covariates which influence both the individual's choice of practice and the practices choice of fundholding status. α_p, υ_{ip}' are zero mean independent practice specific and individual specific error terms, whose sum we denote υ_{ip}.

3.2.1 Selection on observables

The "kitchen sink" method (Wooldridge, 2002) is to include in the satisfaction regression a large set of individual and practice level covariates which predict fundholding. The larger the set of such covariates included the more likely is it that the conditional mean independence assumption

$$E(\varepsilon_{ip} \mid \mathbf{w}_{1ip}, \mathbf{w}_{2p}, \mathbf{x}_{1ip}, \mathbf{x}_{2p}, F_p = 1) - E(\varepsilon_{ip} \mid \mathbf{w}_{1ip}, \mathbf{w}_{2p}, \mathbf{x}_{1ip}, \mathbf{x}_{2p}, F_p = 0)$$

$$= E(\varepsilon_{ip} \mid \mathbf{w}_{1ip}, \mathbf{w}_{2p}, \mathbf{x}_{1ip}, \mathbf{x}_{2p}) - E(\varepsilon_{ip} \mid \mathbf{w}_{1ip}, \mathbf{w}_{2p}, \mathbf{x}_{1ip}, \mathbf{x}_{2p}) = 0 \tag{7}$$

is valid. Conditional mean independence implies that F_{ip} is uncorrelated with ε_{ip}, so that the estimate of the effect of fundholding on satisfaction (δ in (1)) will be unbiased.

3.2.2 Selection on unobservables

Fundholder practices and their patients may differ systematically in characteristics unobservable by the researcher, such as the strength of entrepreneurial attitudes amongst GPs (Whynes et al., 1999) or patient political attitudes to fundholding. If these unobservable practice and patient characteristics associated with the propensity to become a fundholder or belong to a fundholding practice affect satisfaction then the kitchen sink method will not produce unbiased estimates of the effect of fundholding.

We attempt to allow for this possibility by using instrumental variables (IV) techniques. We assume that the unobservable characteristics affecting satisfaction vary across individuals and practices, but have the same effect for fundholder and non-fundholder patients. Then if we can find a set of instruments **g** correlated with F_{ip} but not with ε_{ip}, then the IV estimate of δ will be a consistent estimate of the average effect of fundholding.

We use a more efficient and robust IV estimator (Wooldridge, 2002) which uses a probit model to predict the probability of an individual belonging to a fundholding practice $\hat{F}_{ip}$, conditional on all practice and patient characteristics associated with fundholding status and satisfaction: $\hat{F}_{ip} = \Pr[F_{ip} = 1 | \mathbf{w_{1ip}}, \mathbf{w_{2p}}, \mathbf{x_{1ip}}, \mathbf{x_{2p}}, \mathbf{g}; \pi]$ where π are the parameters to be estimated. The predicted probability $\hat{F}_{ip}$ is then used as a single instrumental variable for fundholding status in the two stage least squares estimation (2SLS) of the satisfaction model, deriving a selection bias free estimate of δ. The approach does not require the model for fundholder selection (6) to be properly specified, merely that the instruments **g** are good predictors of fundholding status.

We estimate the model using the *probit* and *ivreg2* (Stata, 2001; Baum et al., 2003) commands. The usual 2SLS standard errors and test statistics are valid and we use heteroskedasticity consistent standard errors and allow for clustering of the error term within GP practices. To test the validity of our instruments we investigate the over-identifying restrictions that the instruments **g** are correctly excluded from the estimated satisfaction equation and are uncorrelated with the error term ε_{ip}. With $\hat{F}_{ip}$ used as the sole instrument, the model is exactly identified. We test the assumption by employing a one step 2SLS estimator with all the excluded instruments **g** to ensure we satisfy the over-identification requirement of more instruments than endogenous variables. As we estimate the models using robust standard errors, *ivreg2* employs Hansen's J statistic, which is distributed as a chi-squared with degrees of freedom equal to the number of over-identification restrictions (*L-K*), where *L* is the total number of exogenous regressors and *K* the number of exclusion restrictions (over-identified instruments). To test whether the instruments are correlated with fundholding status, we use *ivreg2* to compute the Shea 'partial R^2' statistic and test

the strength of association between the instrument $\hat{F}_{ip}$ and fundholding status conditional on $\mathbf{x}_{1ip}$ and $\mathbf{x}_{2p}$ (Davis and Kim, 2002). This is a likelihood ratio (LR) test of the Shea 'partial R^2' against a test statistic computed as (1-exp($c.v$) /T), where $c.v$ is the critical value from a chi-squared distribution with 1 degree of freedom, and T the sample size. We also look for endogeneity bias with the Durbin-Wu-Hausman test (Davidson and Mackinnon, 1993).

3.3 Direct and indirect effects of fundholding

Our focus is on estimating the overall effect of fundholding on patient satisfaction. Fundholding may have a direct effect on satisfaction because patients care about fundholding status per se, perhaps because of their political beliefs. But patients may also care about fundholding status for instrumental reasons: fundholding changes aspects of the practice which influence their satisfaction, for example waiting times for elective surgery. The overall effect is the sum of these effects.

Suppose that patient satisfaction depends on a variable z_p, for example the outpatient waiting time for practice patients, which is dependent on the fundholding status of the practice:

$$S_{ip}^* = \alpha_0 + \delta F_p + \boldsymbol{\beta}_1' \mathbf{x}_{1ip} + \boldsymbol{\beta}_2' \mathbf{x}_{2p} + \beta_3 z_p + \varepsilon_{ip} \tag{8}$$

$$z_p = \omega_0 + \omega' \mathbf{x}_p + \gamma F_p + \varsigma_p \tag{9}$$

The expected effect of fundholding status on patient satisfaction is

$$E(S_{ip}^* | \mathbf{x}_{1ip}, \mathbf{x}_{2p}, z_p, F_p = 1) - E(S_{ip}^* | \mathbf{x}_{1ip}, \mathbf{x}_{2p}, z_p, F_p = 0) = \delta + \beta_3 \gamma \tag{10}$$

Both effects are properly due to the fundholding status of the practice. If individuals care about fundholding status only for instrumental reasons, such as its effects on waiting times, and we include all such variables in (8), the coefficient on F_{ip} will be zero.

There are two approaches to estimating the overall effect of fundholding on satisfaction. We can estimate separate models for S_{ip}^* and all variables like z_p which are partially determined by fundholding status. Or we can estimate the satisfaction

model after excluding variables like z_p. Dropping all variables influenced by fundholding status will lead to biased estimates of the partial effects of covariates **x** on patient satisfaction if they are correlated with the omitted variables. We decided to adopt the approach of excluding explanatory variables thought to have been influenced by fundholding since it is simpler and our main concern is the effect of fundholding on patient satisfaction, so that bias in the effects of other variables is of less concern.

3.4 Non-response

There were 4441 valid questionnaires returned, giving an overall response rate of 37%. There was an overrepresentation of females (59% against an expected 51%) and those over the age of 65 (27% actual against an expected 19%) when compared with practice populations. Since the regression analysis conditions on observable characteristics of the sample respondents, the representativeness of the sample with respect to observable characteristics is not an important issue.

Of the 4441 useable questionnaires, 4311 respondents answered the question on overall satisfaction. In total 2646 responders had missing items, including 1360 who did not report household income.

Rather than drop observations with missing individual level items we imputed them, with the exception of income. We used a modified version of the *hotdeck* command (Mander and Clayton, 2000) to replace the missing item values in an observation with the relevant items from a randomly selected observation from the set of complete item responders within the same practice. We did not impute missing income items and instead used non-response as an additional income category.

3.5 Estimation procedure

We adopted the following procedure for each of the three regression methods (OLS, ORM, GORM) except that, because of the small proportion (1%) of patients expressing complete dissatisfaction with their practice, we combined the two lowest

satisfaction categories in the GORM estimations. We excluded variables thought to have been influenced by fundholding status such as the average waiting times for outpatient visits and elective inpatient care, and the provision of services, such as physiotherapy, by professions allied to medicine (PAMs).

We first estimated the unconditional effects of the association between GP practice fundholding status and patient satisfaction to provide a benchmark for the subsequent analysis. Next we estimated the effect of fundholding conditional only on individual level variables ($\mathbf{x}_{1ip}$ in (1)). We used a backward stepwise estimation routine with a 5% significance criterion. For categorical variables, we included all categories if at least one category was significant. We then added practice level variables (GP practice characteristics, practice level deprivation and environmental characteristics) ($\mathbf{x}_{2p}$) and again used backward stepwise selection with a 10% significance criterion but forcing the inclusion of all significant individual characteristics from the previous stage.

We estimated the kitchen sink model in three steps. First, we identified individual level covariates associated with fundholding status ($\mathbf{w}_{1ip}$ in (6)) from a probit regression of the binary dependent variable F_{ip} with backward stepwise estimation with a 5% significance level. Second, we included practice level variables associated with fundholding status ($\mathbf{w}_{2p}$) by backward stepwise selection with a 5% significance level, forcing inclusion of the identified individual characteristics from step 1. Third, we estimated a model of patient satisfaction with fundholding status F_{ip}, the set of significant individual and practice level covariates associated with patient satisfaction $\mathbf{x}_{1ip}$ and $\mathbf{x}_{2p}$ derived from the stepwise procedures in the previous paragraph, and the set of individual and practice level variables significantly associated with fundholding status ($\mathbf{w}_{1ip}$, and $\mathbf{w}_{2p}$) derived from the first two steps. The set of instruments used in the IV estimation are the subset of variables in $\mathbf{w}_{1ip}$, and $\mathbf{w}_{2p}$ that do not intersect with $\mathbf{x}_{1ip}$ and $\mathbf{x}_{2p}$.

4 Results

Table 1 gives the full set of patient and practice specific variables used in the analysis. The majority of respondents (over 60%) were at least very satisfied with their GP practice. Figure 1 plots the relative frequencies for each satisfaction category by non-fundholder and fundholder patients. More patients in non-fundholder practices report being completely satisfied or very satisfied with their practice than fundholding patients.

4.1 Unconditional estimates

Column 1 in Tables 3 and 4 and row 1 of Table 6 give unconditional estimates of the impact of fundholding on patient satisfaction from OLS, ordered logistic and generalised ordered logistic models containing only the fundholding dummy and HA dummies. All models indicate a negative effect of fundholding on patient satisfaction significant at the 1% level. The GORM results in table 6 suggest that fundholding had larger negative effects on patients reporting higher levels of satisfaction.

4.2 Conditioning on individual and practice covariates

Column 2 in Tables 3 and 4 and row 2 in Table 6 indicate the effect of conditioning on individual characteristics associated with satisfaction. The negative effect of fundholding is slightly reduced but remains statistically significant at the 5% level. With practice and individual covariates (column 3 in Tables 3 and 4, and row 3 in Table 6) the negative effect of fundholding in the OLS and ordered logit models is similar to the unconditional estimates. In the generalised model, the effects of fundholding on reporting at least somewhat satisfied and at least very satisfied become more negative than in the unconditional estimates when both individual and practice covariates are included.

4.3 Kitchen sink models

Table 2 presents the probit model of patient and practice characteristics associated with fundholding status. Richer individuals are more likely to be in fundholding practices. Individuals with children and those whose health limits their activities were

less likely to be with a fundholding practice. The size of the practice, the proportion of female GPs and whether the practice performed minor surgery are positively associated with fundholding status. Practices with less educated populations are less likely to be fundholders. The inclusion of practice characteristics reduces the significance of the effect of income and children in the household.

The kitchen sink models, formed by adding the variables from the fundholding model to the satisfaction model are reported in column 4 of Tables 3 and 4, and in row 4 of Table 6. There is little change in the estimates of the effects of fundholding. The coefficients on the fundholding dummy remain negative and significant in the OLS and ordered logit, and negative and significant for being at least somewhat satisfied and at least very satisfied in the generalised model.

Tests on the validity of the parallel regression assumption indicate that we can reject the null hypothesis that the effect of covariates are constant across satisfaction categories. The likelihood ratio test has a significant *p*-value (see bottom of Table 5 column 3), suggesting rejection of the null hypothesis that the coefficients are equal across categories. The Aikaike information criterion (AIC) statistics[5] also indicate that the generalised ordered logistic regression provides a better fit to the data than the standard model.

Figure 2 compares plots of the kernel density estimates of the effect of fundholding from the standard and generalised ordered logistic models. The effect is evaluated for the probability of being at least very satisfied (the response of the majority) conditional on the observed characteristics of patients and practices: $\Pr\left(S_{ip} \geq 6 \mid \mathbf{x}_{1ip}, \mathbf{x}_{2p}, F_p = 1\right) - \Pr\left(S_{ip} \geq 6 \mid \mathbf{x}_{1ip}, \mathbf{x}_{2p}, F_p = 0\right)$[6]. The two models produce noticeably different distributions for the effect of fundholding with the generalised ordered logistic model estimating more negative effects with a median value of -0.12 compared to -0.065 with the ordered logistic.

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[5] AIC= -2*log-likelihood + 2 * (number of parameters)

[6] $\Pr\left(S_{ip} \geq j\right) = 1 - \left(\dfrac{1}{1 + \exp\left(\alpha_{j-1} - \hat{\delta}F_p - \hat{\boldsymbol{\beta}}_1'\mathbf{x}_{1ip} - \hat{\boldsymbol{\beta}}_2'\mathbf{x}_{2p}\right)}\right)$

4.4 Instrumental variables estimates

The IV estimates for the OLS and ordered logistic models yield more negative coefficients on the fundholding dummy variable, implying that unobserved factors associated with fundholding status are positively correlated with unobserved factors that increase the level of satisfaction (see Tables 2 and 3 column 5).   In the generalised ordered logistic model the IV estimates only produce a more negative effect of fundholding on reporting being more than somewhat satisfied. The coefficient is reduced slightly for being more than neither satisfied nor dissatisfied and is no longer statistically significant (Table 6 row 5). The Durbin-Wu-Hausman test for endogeneity bias could not reject the null hypothesis that the effect estimated using the "kitchen sink" approach was unbiased (see Tables 2 and 3).

The Shea-R^2 for the predicted probability of becoming a fundholder (our single instrument) indicates that it explained a statistically significant proportion of the additional variation in fundholding status, conditional on other included variables. Hansen J tests of the overidentification restrictions that the instruments do not directly affect patient satisfaction cannot be rejected, implying that the instruments are valid.

4.5 Fundholder waves

Since there is evidence that early wave fundholders had different behaviour to later wave fundholders (Gravelle, Dusheiko, and Sutton, 2002) we   also considered whether the effect of fundholding on patient satisfaction differed by fundholding waves. Our sample of practices included fundholding practices from each of the 7 waves. Table 8 shows that although there is only one wave 2 practice (61 patients), we had reasonably large numbers of patients from the other waves. We estimated the kitchen sink model using standard ordered logistic regression with fundholder wave dummies (see Table 8). Patients across all waves of fundholder practices were less satisfied with their practice. The negative effects were larger in waves 1, 2, 3 and 6 practices and statistically significant for waves 1,3, and 6. The null hypothesis that there is no significant difference between the effects of fundholding in the restricted

and unrestricted models is rejected at the 5% significance level (chi2(7) = 18.44, Prob > chi2 = 0.01). Patients in first wave fundholding practices were significantly less satisfied than the average fundholder patient (chi2(1) = 4.63, Prob > chi2 = 0.032).

4.6 Effects on different types of patient

To test whether fundholding had different effects on the satisfaction of different types of patient we interacted fundholding status with patient level demographic and socio-economic characteristics, including age, gender, ethnicity, household income, employment status and dimensions of the SF-6D health indicator. We also interacted fundholding status with numbers of GP visits and patient views on the convenience of the practice location. The results are reported in Table 7. The effects of fundholding status on satisfaction do not seem to vary with many of the demographic and socio-economic variables. Patients within fundholding practices who rated their practice location as at least very good were significantly more satisfied than non-fundholder patients, and patients reporting emotional difficulties were significantly less satisfied in non-fundholding practices. A Wald test, rejected the null hypothesis that the effects of patient covariates on satisfaction were identical for fundholders and non-fundholders. The base effect of fundholding is still negative though no longer significant. The model with interactions performs worse than the restricted model without interactions according to the Akaike information criterion.

4.7 Direct and indirect effects

We considered the median practice inpatient elective waiting time for the practice in 1998 and the number of PAMs at the practice as potentially influenced by fundholder status. These variables are also likely to affect patient satisfaction and were excluded from the estimates of the satisfaction equation reported above so that the estimate of the fundholding effect is the sum of the direct and indirect effects of fundholding.

We added these variables to the "kitchen sink" model and estimated the ordered logistic regression first including only waiting time measures and then PAMs as we

had observations on only 46 practices for the latter variable. Our estimates indicate that practices with higher median inpatient waiting times had lower patient satisfaction. The estimated effect of fundholding was more negative than in the model without this variable (-0.442, t-stat. = -3.73). This suggests that lower waiting times were associated with fundholding practices. Similarly, the inclusion of PAMs had a positive association with patient satisfaction and lead to a further deterioration in reported satisfaction amongst fundholding patients (-0.567, t-stat = -3.76). The implication is either that patients had an inherent distaste for belonging to a fundholding practice, or that there were other unobserved negative aspects of the effect of fundholding on services to patients, and that this direct effect was only partially offset by shorter waiting times and provision of more PAMs.

4.8 Robustness checks

4.8.1 Unit non-response

Non-response matters only if the probability of non-response depends on the level of satisfaction, and cannot be explained by observable covariates. We used the only observable information we have about patients who did not respond (the practice the individual belonged to), to compare response rates between fundholding and non-fundholding practices. The mean response rates for fundholders and non-fundholders were not significantly different (40% and 41% respectively), which suggests that non-response does not appear to be associated with fundholding status. If we assume that non-respondents are missing at random we can weight the estimates by the inverse of their practice's response rate. Estimates including probability weights of practice response rates to allow for unit non-response decreased the effect of fundholding slightly, but it still remained negative and significant at the 5% significance level (see Table 9). The model using weighting adjustments makes strong assumptions about the pattern of non-response because it assumes that each individual in a GP practice is equally likely to respond to the survey, regardless of their level of satisfaction.

4.8.2 Missing item imputation

To investigate the sensitivity of our estimates to the imputation of missing items we repeated the Hotdeck procedure to create five different imputed data sets. We then used a multiple imputation estimation procedure (Carlin et al., 2003) to account for the additional variance of stochastically imputed missing data.. Using multiple imputation estimators for the OLS and ordered logistic regressions made very little difference to estimated coefficients and standard errors (see Table 9).

4.9   Other covariates

The other covariates served mainly as a control for patient and practice characteristics associated with satisfaction and fundholding status and their coefficients may be biased because of confounding with the omitted variables such as waiting times and PAMs.   Nevertheless, the estimated effects of the included covariates are of some interest and most have plausible signs.

Older patients were more likely to be satisfied, but there was no difference between men and women.   Non-white individuals were less likely to report being satisfied. Generally individuals with worse socio-economic status (living in housing rented from a local authority, being unemployed, unable to work due to long term sickness or disability, lower income) were more satisfied. Poor self-assessed health, in particular individuals reporting feeling tense, downhearted and low was associated with lower patient satisfaction. Individuals with more frequent visits to the GP were more satisfied, and patients who rated the convenience of their practice location highly also reported higher levels of satisfaction.

Patients in larger practices, and with a higher proportion of elderly GPs were significantly less satisfied.   Patients were more satisfied in practices with approved training status, and in practices with better quality of prescribing and patient care. Specifically, a higher ratio of bendrofluazide 2.5mg items to 5mg items (a cardiovascular drug where a lower dose is considered better (Campbell, Cantrill, and Roberts, 2000)), and higher quality care scores for angina patients were associated with higher satisfaction. Patients within GP practices with better access to private health care (beds weighted distance) had lower satisfaction.   Patients in practices in

areas with a higher proportion of individuals claiming incapacity or severe disability allowance were more dissatisfied.

5 Discussion

Our analysis indicates that patients belonging to fundholding practices were less satisfied than non-fundholder patients. If we apply numerical values to the satisfaction categories (from a score of 1 for completely dissatisfied and to a score of 7 for completely satisfied), the unconditional mean satisfaction of patients in fundholding practices is 5.42, compared with mean of 5.61 for patients in non-fundholding practices, a difference of 4.1%. Allowing for individual and practice covariates and for simultaneity makes little difference to this effect, with the kitchen sink estimate of the difference being 3.2%.

The generalised logistic model suggests that fundholding patients were significantly less likely to report being at least somewhat or highly satisfied with their practice. On average, belonging to a fundholding practice reduced the probability of being at least somewhat satisfied by 0.06 (8%) and the probability of reporting being at least highly satisfied by 0.11 (20%). Fundholding had little effect at the other end of the distribution of satisfaction.

The negative effect of fundholding is robust across estimation methods and after controlling for a large number of patient and practice characteristics. Controlling for selection bias by instrumental variables yields somewhat larger negative effects, suggesting that unobserved patient and practice characteristics associated with fundholding were positively associated with satisfaction.

The results provide evidence that budgetary arrangements and financial incentives in GP practice affected the agency role of fundholding GPs, and hence the nature of care experienced by patients. They suggest that savings by fundholding practices may have been at the expense of patient welfare, despite the ability of fundholding practices to invest their savings to improve patient care. This implies that fundholders may not have redirected funds into services or care infrastructure to an extent which

compensated for any reductions in admissions. Alternatively, the added managerial responsibility and transaction costs to fundholder practices could have detracted GP efforts away from the patient care.

We also found that patient satisfaction is sensitive to differences in practice organisation and quality. It is notable that patients were significantly more likely to report higher levels of satisfaction within practices with approved training status, and those with better indicators of prescribing and clinical practice. The results also suggest that non-whites, those in full time employment and those with high incomes are less likely to be satisfied.

Our study suggests that when gatekeeping doctors are given expenditure neutral budgets it cannot be assumed that physician altruism or quality competition for patients will ensure that the average patient will become more satisfied with the resulting changes in service delivery.

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Table 1. Descriptive statistics

Variable	Num. Obs.	Mean	Std. Dev.	Max	Min
Completely dissatisfied	4311	0.01	0.10	1	0
Very dissatisfied	4311	0.03	0.16	1	0
Somewhat dissatisfied	4311	0.06	0.23	1	0
Neither satisfied nor dissatisfied	4311	0.09	0.28	1	0
Somewhat satisfied	4311	0.20	0.40	1	0
Very satisfied	4311	0.39	0.49	1	0
Completely satisfied	4311	0.23	0.42	1	0
Standard fundholder	4441	0.42	0.49	1	0
Age	4441	51.41	17.58	99	17
Male	4441	0.39	0.49	1	0
Non-white	4441	0.09	0.28	1	0
Single	4441	0.13	0.33	1	0
Married/Cohabiting	4441	0.71	0.46	1	0
Divorced/separated	4441	0.07	0.26	1	0
Widowed	4441	0.09	0.29	1	0
0 child household	4441	0.69	0.46	1	0
1 child household	4441	0.12	0.32	1	0
2 child household	4441	0.13	0.33	1	0
3 child household	4441	0.05	0.22	1	0
4 or more child household	4441	0.02	0.12	1	0
Owner occupied/mortgaged	4441	0.78	0.42	1	0
Rented (LA)	4441	0.15	0.36	1	0
Rented (Private)	4441	0.05	0.22	1	0
Other	4441	0.02	0.15	1	0
No cars	4441	0.24	0.43	1	0
One car	4441	0.54	0.50	1	0
Two or more cars	4441	0.22	0.41	1	0
Full time employment	4441	0.34	0.47	1	0
Part time	4441	0.13	0.34	1	0
Self employed	4441	0.06	0.24	1	0
Unemployed	4441	0.02	0.15	1	0
In education/training	4441	0.02	0.13	1	0
Not working (illness/disability)	4441	0.06	0.24	1	0
Retired	4441	0.27	0.45	1	0
Looking after home/family	4441	0.10	0.30	1	0
Income < £3,999	4441	0.05	0.21	1	0
Income £4,000 - £5,999	4441	0.06	0.24	1	0
Income £6,000 - £7,999	4441	0.05	0.23	1	0
Income £8,000 - £9,999	4441	0.05	0.21	1	0
Income £10,000 - £14,999	4441	0.09	0.29	1	0
Income £15,000 - £19,999	4441	0.09	0.29	1	0
Income £20,000 - £29,999	4441	0.07	0.25	1	0
Income £30,000 - £39,999	4441	0.13	0.34	1	0
Income > £39,999	4441	0.10	0.30	1	0
Don't know / would not say	4441	0.31	0.46	1	0
No limited activity (vigorous)	4441	0.33	0.47	1	0
A little activity (vigorous)	4441	0.12	0.33	1	0
A little limited activity (moderate)	4441	0.09	0.28	1	0

A lot limited activity (moderate)	4441	0.02	0.14	1	0
A little limited (bath/dress)	4441	0.03	0.16	1	0
A lot limited (bath/dress)	4441	0.23	0.42	1	0
No physical and emotional limitation	4441	0.65	0.48	1	0
Physical limitation	4441	0.06	0.23	1	0
Emotional limitation	4441	0.07	0.25	1	0
Physical and emotional limitation	4441	0.10	0.30	1	0
No health limit (social)	4441	0.72	0.45	1	0
A little health limit (social)	4441	0.10	0.30	1	0
Some health limit (social)	4441	0.10	0.30	1	0
Health mostly limited (social)	4441	0.05	0.22	1	0
Health limited all the time (social)	4441	0.03	0.17	1	0
No pain	4441	0.60	0.49	1	0
A little pain	4441	0.19	0.39	1	0
Moderate pain	4441	0.08	0.27	1	0
Quite a bit of pain	4441	0.08	0.28	1	0
Extreme pain	4441	0.05	0.21	1	0
Never tense/downhearted	4441	0.30	0.46	1	0
A little tense/downhearted	4441	0.43	0.49	1	0
Sometimes tense/downhearted	4441	0.21	0.40	1	0
Most of time tense/downhearted	4441	0.06	0.23	1	0
All the time tense/downhearted	4441	0.01	0.08	1	0
Doctor visit (0)	4441	0.10	0.30	1	0
Doctor visit (1-2)	4441	0.36	0.48	1	0
Doctor visit (3-4)	4441	0.25	0.43	1	0
Doctor visit (5-6)	4441	0.15	0.35	1	0
Doctor visit (7+)	4441	0.15	0.36	1	0
Practice location very poor	4441	0.01	0.07	1	0
Practice location poor	4441	0.02	0.14	1	0
Practice location fair	4441	0.13	0.33	1	0
Practice location good	4441	0.31	0.46	1	0
Practice location very good	4441	0.30	0.46	1	0
Practice location excellent	4441	0.24	0.43	1	0
Practice characteristics					
Standard fundholder	60	0.42	0.50	1	0
Practice list size	60	5912.23	3914.42	17647	1406
List size per WTE GP	60	2152.30	525.43	3524	990.5
Percentage female GPs	60	0.32	0.31	1	0
GPs under 30	60	0.03	0.08	0.5	0
Proportion of GPs between 30-40	60	0.30	0.32	1	0
Proportion of GPs between 40-50	60	0.30	0.30	1	0
Proportion of GPs between 50- 60	60	0.33	0.39	1	0
Proportion of GPs over 60	60	0.04	0.15	1	0
UK qualified GPs	60	0.67	0.39	1	0
Training practice	60	0.30	0.46	1	0
Asthma GPs	60	0.91	0.28	1	0
Minor surgery practice	60	0.81	0.33	1	0
Deputising GPs	60	0.76	0.42	1	0
Private access	60	0.00	0.00	0.00	0.00
Rural patients	60	0.06	0.16	0.75	0
Bedrofluazide 2.5mg/5mg	60	77.86	21.90	99.62	13.26
Disease management score	47	75.89	18.73	100	25
Disability score	55	83.44	16.55	100	33.33
Teamwork score	46	21.21	1.81	26.3	16.62

Angina care score	59	55.04	6.74	66.75	40.93
Asthma score	60	50.12	12.33	72.9	24.76
Diabetes score	60	62.05	11.84	82.86	32.89
Organisation score	51	84.97	18.93	100	33.33
Prescribing score	51	74.51	19.86	100	28.57
Percentage non-university graduates	60	85.45	6.50	94.75	68.15
Disability allowance	60	105.16	50.30	220.94	41.75
Low income scheme index	60	12.96	10.50	42.05	1.36
Proportion low birth weight	60	7.43	1.83	11.60	3.78
Elderly residential homes	60	0.08	0.06	0.26	0.00
Job seekers allowance	60	5.02	3.64	16.17	1.11
Inward migration	60	0.10	0.03	0.21	0.06
Median inpatient waiting time	55	54.13	16.24	99	23
Number of PAMs	46	0.41	0.93	4	0
Health Authority 1	4441	0.11	0.32	1	0
Health Authority 2	4441	0.12	0.33	1	0
Health Authority 3	4441	0.21	0.41	1	0
Health Authority 4	4441	0.19	0.40	1	0
Health Authority 5	4441	0.20	0.40	1	0
Health Authority 6	4441	0.16	0.37	1	0

Figure 1. Relative frequencies of patient satisfaction categories by fundholding status.
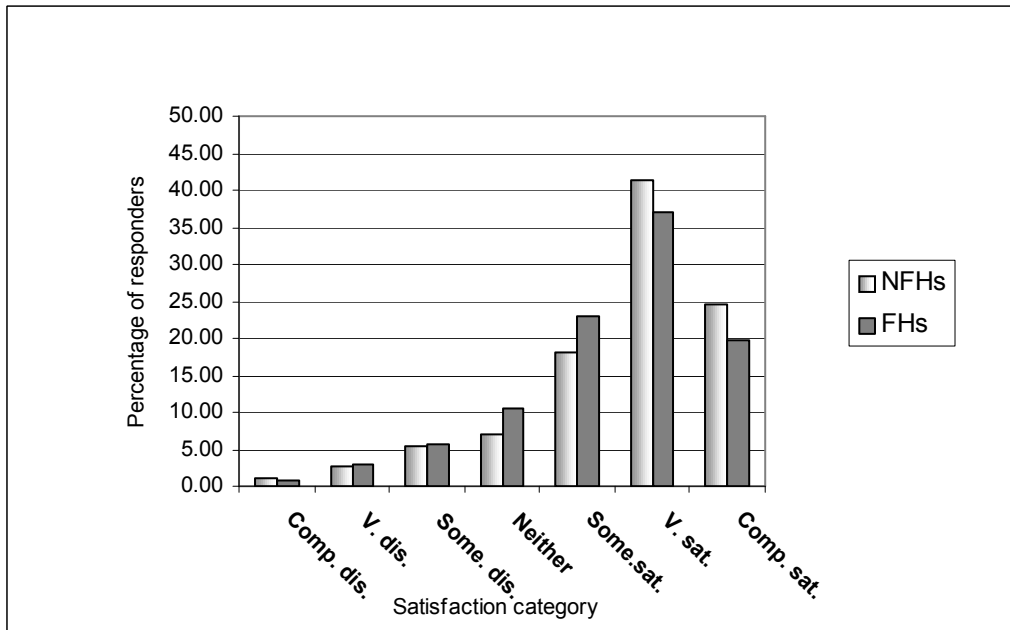
Table 2. Probit regression of fundholder status on patient and practice characteristics

Income < £3,999	-0.25238	-0.0655
	[1.676]	[0.550]
Income £4,000 - £5,999	-0.06391	0.0860
	[0.505]	[0.721]
Income £6,000 - £7,999	-0.17011	-0.0086
	[1.378]	[0.083]
Income £8,000 - £9,999	-0.37556	-0.1804
	[3.154]**	[1.592]
Income £10,000 - £14,999	-0.12866	-0.0330
	[1.476]	[0.359]
Income £15,000 - £19,999	-0.05669	0.0579
	[0.650]	[0.670]
Income £20,000 - £29,999	Reference group	Reference group
Income £30,000 - £39,999	0.13278	-0.0497
	[1.321]	[0.434]
Income > £39,999	0.30816	0.0056
	[2.657]**	[0.049]
Don't know / would not say	-0.12904	-0.0782
	[2.083]*	[1.048]
0 child household	Reference group	Reference group
1 child household	-0.18401	-0.0133
	[2.894]**	[0.163]
2 child household	0.03368	0.1221
	[0.442]	[1.426]
3 child household	-0.02134	0.0733
	[0.223]	[0.636]
4 or more child household	-0.15173	-0.1257
	[0.589]	[0.436]
No physical and emotional limitation	Reference group	Reference group
Physical limitation	-0.13542	-0.1609
	[2.114]*	[2.502]*
Emotional limitation	0.10558	-0.0190
	[0.936]	[0.198]
Physical and emotional limitation	0.04068	0.1386
	[0.393]	[1.155]
Practice list size		0.1736
		[2.373]*
Percentage female GPs		1.9367
		[2.394]*
Minor surgery practice		3.7179
		[3.487]**
Percentage non-university graduate		-0.1408
		[3.553]**

Health Authority 1	0.01855	1.7185
	[0.031]	[2.278]*
Health Authority 2	-0.90895	-2.0610
	[1.292]	[2.433]*
Health Authority 3	0.04727	1.4462
	[0.082]	[2.036]*
Health Authority 4	Reference group	Reference group
Health Authority 5	-0.14603	-0.2583
	[0.258]	[0.363]
Health Authority 6	1.36202	4.2661
	[1.881]	[5.143]**
Constant	-0.18842	5.9195
	[0.462]	[1.751]
Observations	4311	4311

Robust z statistics in brackets

* significant at 5%; ** significant at 1%

Table 3. Determinants of satisfaction: OLS estimates

Overall satisfaction	Unconditional	Individual level covariates	Practice level variables	Kitchen sink	IV
Standard fundholder	-0.229	-0.157	-0.194	-0.176	-0.219
	[2.77]*	[2.019]*	[3.029]**	[2.357]*	[2.473]*
Age		0.006	0.006	0.007	0.006
		[3.117]**	[3.193]**	[3.344]**	[3.225]**
Non-white		-0.379	-0.381	-0.380	-0.379
		[3.953]**	[3.947]**	[3.937]**	[3.981]**
0 Child household		Ref group	Ref group	Ref group	Ref group
1 Child household		-0.007	-0.031	-0.037	-0.032
		[0.103]	[0.484]	[0.573]	[0.509]
2 Child household		0.071	0.043	0.040	0.043
		[1.236]	[0.745]	[0.702]	[0.756]
3 Child household		-0.039	-0.048	-0.049	-0.048
		[0.418]	[0.513]	[0.531]	[0.519]
4 or more Child household		0.321	0.305	0.315	0.304
		[2.150]*	[2.049]*	[2.095]*	[2.070]*
Income < £3,999		-0.207	-0.263	-0.262	-0.263
		[1.683]	[2.105]*	[2.110]*	[2.136]*
Income £4,000 - £5,999		-0.017	-0.033	-0.025	-0.032
		[0.198]	[0.383]	[0.284]	[0.382]
Income £6,000 - £7,999		-0.077	-0.061	-0.059	-0.061
		[0.790]	[0.624]	[0.591]	[0.637]
Income £8,000 - £9,999		0.150	0.136	0.142	0.136
		[1.651]	[1.424]	[1.466]	[1.434]
Income £10,000 - £14,999		-0.001	-0.014	-0.009	-0.014
		[0.017]	[0.172]	[0.114]	[0.177]
Income £15,000 - £19,999		0.070	0.064	0.065	0.064
		[1.433]	[1.304]	[1.323]	[1.328]
Income £20,000 - £29,999		Ref group	Ref group	Ref group	Ref group
Income £30,000 - £39,999		-0.093	-0.074	-0.074	-0.073
		[1.213]	[0.981]	[0.986]	[0.991]
Income > £39,999		-0.186	-0.163	-0.159	-0.162
		[2.799]**	[2.415]*	[2.337]*	[2.441]*
Don't know / would not say		-0.083	-0.095	-0.094	-0.095
		[1.656]	[1.958]	[1.962]	[1.997]*
Doctor visit (0)		-0.219	-0.225	-0.224	-0.225
		[3.987]**	[4.276]**	[4.317]**	[4.333]**
Doctor visit (1-2)		Ref group	Ref group	Ref group	Ref group

Doctor visit (3-4)	0.071	0.067	0.076	0.068
	[1.684]	[1.602]	[1.823]	[1.635]
Doctor visit (5-6)	0.055	0.040	0.057	0.040
	[0.883]	[0.660]	[0.959]	[0.668]
Doctor visit (7+)	0.267	0.245	0.274	0.246
	[4.741]**	[4.028]**	[4.683]**	[4.089]**
Practice location very poor	-0.105	-0.094	-0.118	-0.093
	[0.328]	[0.284]	[0.352]	[0.283]
Practice location poor	-0.721	-0.650	-0.666	-0.649
	[3.935]**	[3.592]**	[3.640]**	[3.646]**
Practice location fair	-0.264	-0.275	-0.273	-0.275
	[3.882]**	[4.156]**	[4.158]**	[4.233]**
Practice location good	Ref group	Ref group	Ref group	Ref group
Practice location very good	0.33254	0.32839	0.32537	0.328
	[8.525]**	[8.223]**	[8.207]**	[8.342]**
Practice location excellent	0.64482	0.62569	0.62353	0.626
	[12.991]**	[13.502]**	[13.384]**	[13.661]**
Owner occupied/mortgaged	Ref group	Ref group	Ref group	Ref group
Rented (Local Authority)	0.134	0.132	0.124	0.132
	[2.154]*	[2.113]*	[1.932]	[2.148]*
Rented (Private)	-0.121	-0.102	-0.097	-0.104
	[1.204]	[0.997]	[0.952]	[1.030]
Other	0.059	0.046	0.045	0.046
	[0.464]	[0.373]	[0.364]	[0.382]
Full time employment	Ref group	Ref group	Ref group	Ref group
Part time	-0.012	0.006	0.004	0.006
	[0.185]	[0.094]	[0.055]	[0.093]
Self employed	-0.190	-0.172	-0.166	-0.172
	[2.549]*	[2.308]*	[2.201]*	[2.344]*
Unemployed	0.301	0.317	0.335	0.316
	[2.288]*	[2.329]*	[2.448]*	[2.358]*
In education/training	0.339	0.387	0.406	0.389
	[3.042]**	[3.345]**	[3.573]**	[3.442]**
Not working (illness/disability)	0.303	0.320	0.351	0.319
	[3.423]**	[3.628]**	[4.067]**	[3.685]**
Retired	0.072	0.093	0.111	0.094
	[1.109]	[1.475]	[1.748]	[1.502]
Looking after home	-0.016	-0.006	0.002	-0.005
	[0.235]	[0.093]	[0.029]	[0.083]
Never tense/downhearted	0.172	0.158	0.148	0.159

		[4.084]**	[3.790]**	[3.491]**	[3.861]**
A little tense/downhearted		Ref group	Ref group	Ref group	Ref group
Sometimes tense/downhearted		-0.174	-0.178	-0.150	-0.178
		[3.920]**	[3.968]**	[3.614]**	[4.017]**
Most of time tense/downhearted		-0.223	-0.244	-0.176	-0.242
		[2.729]**	[2.972]**	[1.998]	[2.982]**
All the time tense/downhearted		-0.050	0.080	0.124	0.080
		[0.158]	[0.268]	[0.400]	[0.274]
No physical and emotional limitation		Ref group	Ref group	Ref group	
Physical limitation				-0.083	
				[1.375]	
Emotional limitation				-0.197	
				[1.929]	
Physical and emotional limitation				-0.078	
				[0.800]	
Practice list size			-0.017	-0.015	-0.015
			[2.043]*	[1.992]	[1.861]
Training practice			0.267	0.267	0.269
			[5.938]**	[6.064]**	[6.119]**
Proportion of GPs over 60			-0.600	-0.594	-0.607
			[5.360]**	[5.285]**	[5.424]**
Private access			-1.732	-1.807	-1.733
			[2.348]*	[2.490]*	[2.364]*
Inward migration			2.386	2.829	2.491
			[1.676]	[2.092]*	[1.787]
Disability allowance			0.002	0.002	0.002
			[2.649]*	[1.440]	[2.374]*
Bedrofluazide 2.5mg/5mg			0.004	0.004	0.004
			[2.906]**	[3.037]**	[2.971]**
Angina care score			0.011	0.012	0.011
			[3.056]**	[3.190]**	[3.009]**
Percentage female GPs				-0.140	
				[1.662]	
Minor surgery practice				-0.016	
				[0.206]	
Percentage non-university graduate				0.002	
				[0.342]	
Health Authority 1	-0.214	-0.117	0.069	0.077	0.079
	[1.867]	[1.001]	[0.583]	[0.649]	[0.664]
Health Authority 2	-0.552	-0.307	0.466	0.530	0.459
	[4.360]**	[2.685]**	[1.361]	[1.557]	[1.333]

Health Authority 3		Ref group	Ref group	Ref group	Ref group
Health Authority 4	-0.237	-0.112	0.396	0.372	0.401
	[1.523]	[0.825]	[2.995]**	[2.483]*	[3.092]**
Health Authority 5	-0.107	-0.070	0.101	0.091	0.097
	[0.910]	[0.609]	[1.105]	[0.896]	[1.014]
Health Authority 6	-0.198	-0.104	-0.039	-0.051	-0.017
	[1.980]	[1.089]	[0.333]	[0.442]	[0.132]
Constant	5.816	5.137	4.265	4.077	4.237
	[69.078]**	[31.754]**	[14.670]**	[7.828]**	[14.102]**
Observations	4311	4311	4280	4280	4280
Adjusted R-squared	0.0181	0.123	0.140	0.141	
Ramsey RESET test				F(3, 4218) = 3.65	
				Prob > F = 0.012	
Akaike information criterion				13858.1	
Shea Partial R-squared					0.364
					F(1, 4227) = 2413.6
					Prob > F = 0.00
Hansen J-statistic					
					8.593
					Chi2(5) P-val = 0.126
Durbin-Wu-Hausman					0.038
					[0.28]

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 4. Determinants of satisfaction: ordered logistic model

Overall satisfaction	Unconditional	Individual characteristics	Practice characteristics	Kitchen sink	IV
Standard fundholder	-0.375	-0.296	-0.338	-0.297	-0.450
	[2.77]*	[2.275]*	[3.0879]**	[2.2506]*	[2.939]**
Age		0.013	0.013	0.014	0.013
		[4.253]**	[4.3026]**	[4.4650]**	[4.286]**
Non-white		-0.478	-0.507	-0.479	-0.498
		[3.629]**	[3.6725]**	[3.5066]**	[3.507]**
0 Child household		Ref. group	Ref. group	Ref. group	Ref. group
1 Child household		-0.039	-0.084	-0.091	-0.089
		[0.428]	[0.9186]	[0.9954]	[0.986]
2 Child household		0.117	0.073	0.072	0.071
		[1.491]	[0.9260]	[0.9139]	[0.906]
3 Child household		-0.067	-0.081	-0.080	-0.076
		[0.518]	[0.6245]	[0.6222]	[0.589]
4 or more Child household		0.494	0.502	0.519	0.497
		[1.977]*	[1.9772]*	[2.0403]*	[1.965]*
Income < £3,999		-0.198	-0.283	-0.291	-0.282
		[1.076]	[1.4606]	[1.5119]	[1.460]
Income £4,000 - £5,999		0.183	0.159	0.167	0.157
		[1.350]	[1.1490]	[1.2246]	[1.157]
Income £6,000 - £7,999		0.090	0.115	0.110	0.111
		[0.648]	[0.8077]	[0.7619]	[0.775]
Income £8,000 - £9,999		0.272	0.246	0.253	0.237
		[1.946]	[1.6482]	[1.6888]	[1.569]
Income £10,000 - £14,999		0.023	0.012	0.015	0.011
		[0.203]	[0.1066]	[0.1251]	[0.091]
Income £15,000 - £19,999		0.182	0.189	0.183	0.189
		[2.397]*	[2.3955]*	[2.3411]*	[2.444]*
Income £20,000 - £29,999		Ref. group	Ref. group	Ref. group	Ref. group
Income £30,000 - £39,999		-0.096	-0.062	-0.062	-0.063
		[0.881]	[0.5713]	[0.5637]	[0.576]
Income > £39,999		-0.191	-0.158	-0.148	-0.156
		[2.073]*	[1.7255]	[1.6240]	[1.697]
Don't know / would not say		-0.024	-0.035	-0.036	-0.040
		[0.353]	[0.5015]	[0.5295]	[0.573]
Doctor visit (0)		-0.338	-0.350	-0.348	-0.347
		[4.004]**	[4.4731]**	[4.4551]**	[4.420]**
Doctor visit (1-2)		Ref. group	Ref. group	Ref. group	Ref. group
Doctor visit (3-4)		0.082	0.087	0.097	0.090
		[1.280]	[1.3379]	[1.5612]	[1.382]

Doctor visit (5-6)	0.147	0.137	0.163	0.138
	[1.594]	[1.4573]	[1.7700]	[1.480]
Doctor visit (7+)	0.530	0.512	0.553	0.514
	[5.659]**	[5.0935]**	[5.7479]**	[5.140]**
Practice location very poor	-0.197	-0.268	-0.307	-0.236
	[0.390]	[0.4972]	[0.5624]	[0.424]
Practice location poor	-0.893	-0.851	-0.877	-0.847
	[3.885]**	[3.6086]**	[3.6872]**	[3.596]**
Practice location fair	-0.429	-0.460	-0.460	-0.460
	[4.702]**	[5.0543]**	[5.0830]**	[5.077]**
Practice location good	Ref. group	Ref. group	Ref. group	Ref. group
Practice location very good	0.562	0.571	0.567	0.572
	[9.394]**	[9.2739]**	[9.2236]**	[9.280]**
Practice location excellent	1.277	1.264	1.266	1.263
	[16.721]**	[17.5276]**	[17.5963]**	[17.552]**
Owner occupied/mortgaged	Ref. group	Ref. group	Ref. group	Ref. group
Rented (Local Authority)	0.327	0.333	0.312	0.336
	[3.269]**	[3.2295]**	[2.9464]**	[3.188]**
Rented (Private)	-0.150	-0.139	-0.134	-0.146
	[0.989]	[0.8753]	[0.8448]	[0.907]
Other	0.106	0.087	0.084	0.089
	[0.524]	[0.4434]	[0.4249]	[0.461]
Full time employment	Ref. group	Ref. group	Ref. group	Ref. group
Part time	-0.021	0.006	0.000	0.006
	[0.231]	[0.0639]	[0.0023]	[0.065]
Self employed	-0.240	-0.215	-0.201	-0.215
	[2.101]*	[1.8629]	[1.6978]	[1.835]
Unemployed	0.375	0.429	0.466	0.424
	[1.835]	[1.9169]	[2.0561]*	[1.919]
In education/training	0.410	0.422	0.458	0.431
	[2.206]*	[2.0683]*	[2.2946]*	[2.162]*
Not working (illness/disability)	0.590	0.619	0.659	0.614
	[3.926]**	[4.0425]**	[4.3256]**	[3.982]**
Retired	0.135	0.181	0.212	0.181
	[1.338]	[1.8164]	[2.1353]*	[1.831]
Looking after home	-0.047	-0.037	-0.019	-0.036
	[0.442]	[0.3449]	[0.1720]	[0.328]
Never tense/downhearted	0.347	0.323	0.307	0.323
	[5.064]**	[4.6120]**	[4.3024]**	[4.596]**
A little tense/downhearted	Ref. group	Ref. group	Ref. group	Ref. group
Sometimes tense/downhearted	-0.229	-0.248	-0.223	-0.245

	[3.758]**	[3.8777]**	[3.5857]**	[3.805]**
Most of time tense/downhearted	-0.403	-0.434	-0.364	-0.425
	[3.081]**	[3.3085]**	[2.5785]**	[3.160]**
All the time tense/downhearted	0.093	0.197	0.209	0.200
	[0.206]	[0.4265]	[0.4251]	[0.436]
No physical and emotional limitation	Ref. group	Ref. group	Ref. group	
Physical limitation			-0.131	
			[1.3408]	
Emotional limitation			-0.247	
			[1.7276]	
Physical and emotional limitation			-0.037	
			[0.2529]	
Practice list size		-0.032	-0.031	-0.026
		[2.5142]*	[2.5314]*	[2.131]*
Training practice		0.450	0.453	0.457
		[6.4296]**	[6.5524]**	[5.554]**
Proportion of GPs over 60		-0.873	-0.863	-0.908
		[3.4538]**	[3.2345]**	[3.926]**
Private access		-2.857	-2.897	-2.829
		[4.3525]**	[4.5108]**	[2.404]*
Inward Migration		4.272	5.579	4.706
		[2.2889]*	[2.4387]*	[2.198]*
Disability allowance		0.004	0.002	0.003
		[3.1379]**	[1.1268]	[2.528]*
Bedrofluazide 2.5mg/5mg		0.006	0.006	0.006
		[1.8685]	[2.6535]**	[2.506]*
Angina care score		0.021	0.021	0.023
		[2.5710]*	[2.6869]**	[3.108]**
Percentage female GPs			-0.272	
			[1.8466]	
Minor surgery practice			0.090	
			[0.6424]	
Percentage non-university graduate			0.011	
			[1.12]	
Health Authority 1	-0.051	0.215	0.269	0.262
	[0.253]	[1.2540]	[1.49]	[1.306]
Health Authority 2	-0.462	0.746	0.887	0.697
	[2.421]*	[1.2885]	[1.57]	[1.207]
Health Authority 3	Ref. group	Ref. group	Ref. group	Ref. group
Health Authority 4	-0.112	0.716	0.606	0.737
	[0.470]	[3.1589]**	[2.46]*	[3.259]**
Health Authority 5	-0.093	0.174	0.126	0.153
	[0.487]	[1.1929]	[0.76]	[0.883]
Health Authority 6	-0.106	-0.043	0.010	0.056

	[0.635]	[0.2442]	[0.05]	[0.264]
Observations	4311	4280	4280	4280
Ramsey RESET test			chi2(3) = 8.45	
			Prob>chi2 = 0.038	
LR test of Parallel			chi2(264) = 660.65	
regression assumption			Prob > chi2 = 0.00	
Akaike information criterion			12301.1	
Durbin-Wu-Hausman				0.172
				[0.73]

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 5. Determinants of satisfaction: generalised ordered logistic estimates, kitchen sink model.

Overall satisfaction	≥ Somewhat dissatisfied	≥ Neither satisfied/dissatisfied	≥ Somewhat satisfied	≥ Very satisfied	Completely satisfied
Standard fundholder	-0.28789	-0.15889	-0.42652	-0.54533	-0.0867
	[0.653]	[0.779]	[3.070]**	[3.581]**	[0.540]
Age	-0.01975	0.00328	0.01403	0.01792	0.0126
	[1.709]	[0.578]	[3.715]**	[5.238]**	[3.206]**
Non-white	-1.24473	-0.61169	-0.55874	-0.43753	-0.21576
	[2.501]*	[2.638]**	[3.589]**	[3.126]**	[1.389]
0 child household	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group
1 child household	-0.09831	-0.16677	-0.0996	-0.03746	-0.28634
	[0.177]	[1.013]	[0.752]	[0.324]	[2.037]*
2 child household	0.23113	-0.03354	-0.02455	0.09485	0.01381
	[0.450]	[0.169]	[0.216]	[1.071]	[0.102]
3 child household	-0.01276	-0.25959	-0.00302	-0.08983	-0.15118
	[0.019]	[0.917]	[0.018]	[0.657]	[0.680]
4 or more child household	0.44965	0.60784	0.45928	0.33097	0.60566
	[0.393]	[1.116]	[1.126]	[1.217]	[1.992]*
Income < £3,999	0.09118	-0.38952	-0.77392	-0.58466	0.30271
	[0.111]	[1.077]	[2.898]**	[2.708]**	[1.193]
Income £4,000 - £5,999	-0.60429	-0.21269	-0.19605	-0.11393	0.7504
	[0.715]	[0.734]	[0.937]	[0.700]	[4.164]**
Income £6,000 - £7,999	-0.78264	-0.66466	-0.47261	-0.11586	0.68036
	[1.417]	[2.282]*	[2.050]*	[0.864]	[3.484]**
Income £8,000 - £9,999	-0.59772	0.4391	0.23846	0.10389	0.55598
	[0.799]	[0.988]	[0.761]	[0.560]	[2.840]**
Income £10,000 - £14,999	-0.40739	-0.13897	-0.01519	-0.04115	0.25438
	[0.575]	[0.444]	[0.069]	[0.278]	[1.280]
Income £15,000 - £19,999	-0.61005	-0.03191	0.05975	0.17968	0.44007
	[1.010]	[0.116]	[0.341]	[1.548]	[2.561]*
Income £20,000 - £29,999	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group
Income £30,000 - £39,999	-1.32075	0.08257	-0.18664	-0.26552	0.28316
	[1.868]	[0.319]	[0.976]	[1.745]	[1.325]
Income > £39,999	-1.13679	-0.52713	-0.4156	-0.2745	0.23533
	[1.979]*	[2.085]*	[2.249]*	[2.296]*	[1.275]
Don't know / would not say	-1.11383	-0.35978	-0.33377	-0.21779	0.44502
	[2.233]*	[1.723]	[2.047]*	[2.002]*	[3.081]**
Doctor visit (0)	-0.45017	-0.04223	-0.43988	-0.37104	-0.24709
	[0.911]	[0.224]	[3.641]**	[3.336]**	[1.824]
Doctor visit (1-2)	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group

Doctor visit (3-4)	0.15025	0.03413	0.25119	0.19775	-0.0575
	[0.514]	[0.210]	[2.436]*	[2.393]*	[0.572]
Doctor visit (5-6)	-0.96944	-0.26564	0.09128	0.14653	0.3213
	[2.274]*	[1.549]	[0.760]	[1.264]	[2.494]*
Doctor visit (7+)	-0.3718	0.56352	0.46883	0.54209	0.63471
	[0.752]	[2.851]**	[3.174]**	[4.956]**	[4.629]**
Practice location very poor	19.52387	-0.62748	-0.55979	-0.38601	0.07859
	[10.413]**	[0.731]	[0.931]	[0.670]	[0.084]
Practice location poor	-1.03347	-1.75132	-0.65349	-0.70819	-1.2668
	[1.677]	[5.455]**	[2.389]*	[2.677]**	[2.324]*
Practice location fair	-0.15937	-0.45914	-0.52574	-0.65358	-0.25476
	[0.366]	[2.763]**	[4.452]**	[6.107]**	[1.485]
Practice location good	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group
Practice location very good	-0.0257	0.11744	0.52665	0.5837	0.69107
	[0.110]	[0.862]	[6.521]**	[8.340]**	[6.522]**
Practice location excellent	0.16425	0.38983	0.78092	1.14048	1.60358
	[0.400]	[2.389]*	[5.902]**	[11.743]**	[17.706]**
Owner occupied/mortgaged	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group
Rented (Local Authority)	-0.37328	-0.07922	-0.01359	0.04472	0.62804
	[0.808]	[0.427]	[0.100]	[0.370]	[5.592]**
Rented (Private)	-0.63784	-0.46286	-0.14464	-0.20279	0.01177
	[1.444]	[1.628]	[0.782]	[1.290]	[0.052]
Other	-1.4724	0.01923	0.12143	0.12349	0.15539
	[1.689]	[0.054]	[0.567]	[0.479]	[0.633]
Full time employment	Ref. group	Ref. group	Ref. group	Ref. group	Ref. group
Part time	-0.54305	0.11659	0.18194	0.0278	-0.01579
	[1.137]	[0.576]	[1.359]	[0.253]	[0.115]
Self employed	-0.65334	-0.40173	-0.3475	-0.18425	-0.03996
	[1.162]	[2.357]*	[2.234]*	[1.222]	[0.209]
Unemployed	-1.87845	1.57883	0.55801	0.33445	0.32487
	[1.666]	[2.643]**	[1.774]	[1.117]	[1.257]
In education/training	18.52496	2.21616	0.88998	0.52451	-0.07314
	[17.769]**	[3.018]**	[2.648]**	[2.139]*	[0.163]
Not working (illness/disability)	-0.89405	0.36587	0.7821	0.73394	0.51414
	[1.352]	[1.171]	[3.528]**	[4.160]**	[2.636]**
Retired	-0.74652	-0.021	0.21199	0.27107	0.16967
	[1.475]	[0.097]	[1.408]	[2.116]*	[1.301]
Looking after home	-0.62139	0.06713	0.29608	0.10727	-0.18866
	[1.080]	[0.358]	[1.890]	[0.866]	[1.046]
Never tense/downhearted	-0.20685	0.08584	0.03746	0.33224	0.4829
	[0.605]	[0.565]	[0.377]	[4.034]**	[4.309]**
A little	Ref. group	Ref. group	Ref. group	Ref.	Ref. group

tense/downhearted

Sometimes tense/downhearted	0.17253	-0.22961	-0.37091	-0.1802	-0.21292
	[0.448]	[1.573]	[3.779]**	[2.129]*	[2.115]*
Most of time tense/downhearted	1.29116	0.15645	-0.34335	-0.4663	-0.20001
	[2.136]*	[0.670]	[2.044]*	[2.780]**	[0.927]
All the time tense/downhearted	-22.55787	18.24647	0.31624	0.48623	0.3952
	[20.022]**	[42.274]**	[0.473]	[1.089]	[0.792]
No physical and emotional limitation	Ref. group	Ref. group	Ref. group	Ref.	Ref. group
Physical limitation	0.40151	-0.23261	-0.35508	-0.19165	-0.00314
	[1.004]	[1.272]	[2.669]**	[1.955]	[0.023]
Emotional limitation	-1.00308	-0.75689	-0.43475	-0.15716	-0.1862
	[2.018]*	[3.092]**	[2.407]*	[0.894]	[0.935]
Physical and emotional limitation	-0.21208	-0.29096	-0.3351	-0.01049	0.09885
	[0.466]	[1.079]	[1.700]	[0.075]	[0.571]
Practice list size	-0.03104	-0.03378	-0.01471	-0.02303	-0.04796
	[0.643]	[1.756]	[1.273]	[1.698]	[2.924]**
Training practice	0.74743	0.51731	0.50833	0.48707	0.42659
	[2.104]*	[3.032]**	[5.661]**	[4.826]**	[4.205]**
Proportion of GPs over 60	-0.11307	-1.06789	-1.26002	-1.03179	-0.27452
	[0.157]	[4.685]**	[5.648]**	[4.364]**	[1.324]
Private access	-4.95653	-5.22412	-2.5882	-3.01089	-3.45322
	[1.609]	[2.223]*	[1.873]	[2.114]*	[2.457]*
Disability allowance	0.00894	0.0025	-0.00052	0.00193	0.00379
	[0.740]	[0.606]	[0.170]	[0.796]	[1.780]
Bedrofluazide 2.5mg/5mg	0.01155	0.00585	0.00493	0.00563	0.00774
	[1.263]	[1.738]	[1.842]	[2.318]*	[2.625]**
Angina care score	-0.00584	0.01316	0.0222	0.0281	0.01824
	[0.164]	[1.098]	[2.865]**	[3.514]**	[2.011]*
Percentage female GPs	0.3055	-0.20096	-0.28136	-0.18735	-0.45111
	[0.418]	[0.563]	[1.414]	[1.037]	[2.779]**
Minor surgery practice	0.17159	-0.2084	-0.10237	0.0179	0.29958
	[0.335]	[0.910]	[0.579]	[0.098]	[1.720]
Percentage non-university graduate	-0.05084	0.00632	0.01155	0.00213	0.02673
	[0.814]	[0.328]	[0.818]	[0.180]	[2.193]*
Inward Migration	11.04213	8.25588	4.339	5.19524	7.86542
	[1.275]	[1.832]	[1.576]	[1.969]*	[3.406]**
Health Authority 1	-1.1245	-0.26441	0.10675	0.31255	0.35523
	[0.948]	[0.807]	[0.453]	[1.331]	[1.836]
Health Authority 2	0.94605	1.67957	0.85085	0.75545	1.12635
	[0.606]	[1.637]	[1.319]	[1.102]	[1.615]
Health Authority 3	Ref. group	Ref. group	Ref. group	Ref.	Ref. group

Health Authority 4	0.0286	0.59772	0.43231	0.58788	0.80577
	[0.034]	[1.494]	[1.686]	[2.111]*	[2.557]*
Health Authority 5	-0.17515	0.1889	0.10945	0.09714	0.23623
	[0.242]	[0.580]	[0.488]	[0.516]	[0.981]
Health Authority 6	-1.07001	-0.22256	0.15109	0.10269	-0.05015
	[0.908]	[0.652]	[0.590]	[0.429]	[0.234]
Constant	9.71443	1.79141	-0.99448	-2.54233	-7.47102
	[2.366]*	[1.308]	[0.795]	[2.471]*	[6.287]**
Observations	4280				
Akaike information criterion	12009.1				

Robust t statistics in brackets

* significant at 5%; ** significant at 1%

Table 6. Summary of estimates of fundholder effects: generalised oredered logistic model

	≥ Somewhat dissatisfied	≥ Neither satisfied/dissatisfied	≥ Somewhat satisfied	≥ Very satisfied	Completely satisfied
(1) **Unconditional**	-0.086 [0.521]	-0.1731 [1.079]	-0.3308 [2.435]*	-0.4552 [3.479]**	-0.3281 [1.850]
(2) **Individual characteristics**	0.10491 [0.482]	-0.12065 [0.681]	-0.29148 [2.029]*	-0.41317 [3.012]**	-0.25886 [1.570]
(3) **Practice characteristics**	-0.23833 [0.589]	-0.19435 [0.996]	-0.44132 [3.327]**	-0.54041 [3.616]**	-0.03402 [0.219]
(4) **Kitchen sink**	-0.28789 [0.653]	-0.15889 [0.779]	-0.42652 [3.070]**	-0.54533 [3.581]**	-0.0867 [0.540]
(5) **IV**	0.79391 [1.423]	-0.27214 [0.958]	-0.36279 [1.652]	-0.7201 [4.060]**	-0.36015 [1.594]

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Figure 2. Kernel density estimates of the effect of fundholding on the probability of being at least very satisfied ($S \geq 6$).
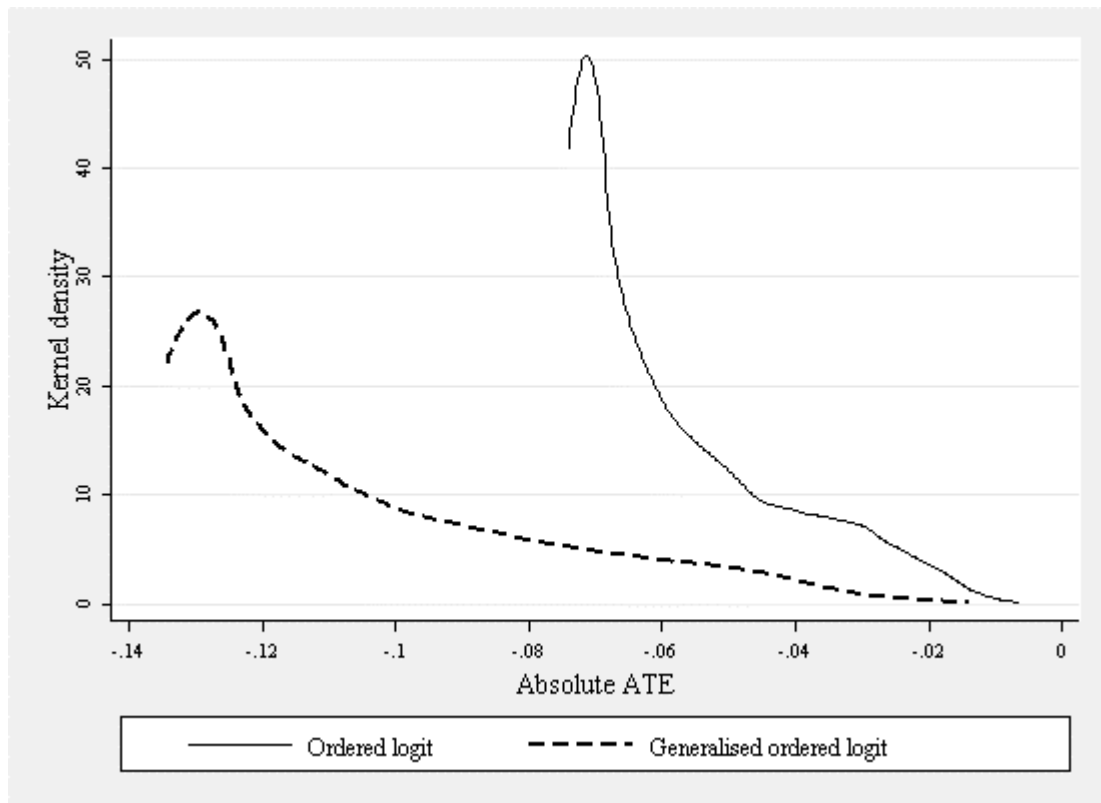
Table 7. Ordered logistic model with fundholder interaction effects

	Kitchen sink	
	Main effect of variable	Interaction with fundholder status
Standard fundholder	-0.188	
	[0.75]	
Age	0.013	0.003
	[2.89]**	[0.55]
Male	-0.004	-0.175
	[0.06]	[1.28]
Non-white	-0.510	0.115
	[2.51]*	[0.40]
0 Child household	Ref group	Ref group
1 Child household	-0.001	-0.200
	[0.01]	[1.07]
2 Child household	0.116	-0.104
	[0.94]	[0.66]
3 Child household	-0.085	-0.050
	[0.51]	[0.18]
4 or more Child household	0.427	0.159
	[1.22]	[0.32]
Income < £3,999	-0.088	-0.502
	[0.34]	[1.30]
Income £4,000 - £5,999	0.293	-0.259
	[1.44]	[0.91]
Income £6,000 - £7,999	0.024	0.183
	[0.13]	[0.68]
Income £8,000 - £9,999	0.299	-0.065
	[1.64]	[0.20]
Income £10,000 - £14,999	0.100	-0.211
	[0.63]	[0.90]
Income £15,000 - £19,999	0.157	0.059
	[1.56]	[0.37]
Income £20,000 - £29,999	Ref group	Ref group
Income £30,000 - £39,999	-0.063	-0.041
	[0.43]	[0.19]
Income > £39,999	-0.098	-0.144
	[0.74]	[0.80]
Don't know / would not say	0.015	-0.143
	[0.17]	[0.99]
Doctor visit (0)	-0.247	-0.172
	[2.35]*	[1.07]
Doctor visit (1-2)	Ref group	Ref group
Doctor visit (3-4)	0.139	-0.089
	[1.90]	[0.68]
Doctor visit (5-6)	0.213	-0.131
	[1.71]	[0.69]
Doctor visit (7+)	0.542	-0.004

	[4.68]**	[0.02]
Practice location very poor	0.323	-1.224
	[0.377]	[1.19]
Practice location poor	-0.998	0.206
	[3.20]**	[0.41]
Practice location fair	-0.606	0.321
	[5.09]**	[1.8]
Practice location good	Ref group	Ref group
Practice location very good	0.446	0.275
	[4.78]**	[2.39]*
Practice location excellent	1.144	0.282
	[14.46]**	[2.0]*
Owner occupied/mortgaged	Ref group	Ref group
Rented (Local Authority)	0.249	0.131
	[1.81]	[0.62]
Rented (Private)	-0.057	-0.215
	[0.32]	[0.61]
Other	0.138	-0.216
	[0.52]	[0.55]
Full time employment	Ref group	Ref group
Part time	0.006	-0.054
	[0.06]	[0.28]
Self employed	-0.168	-0.025
	[1.05]	[0.1]
Unemployed	0.298	0.465
	[1.05]	[1.00]
In education/training	0.456	0.084
	[1.55]	[0.2]
Not working (illness/disability)	0.724	-0.133
	[3.49]**	[0.42]
Retired	0.248	-0.098
	[1.86]	[0.5]
Looking after home	0.036	-0.202
	[0.26]	[0.83]
Never tense/downhearted	0.364	-0.112
	[3.67]**	[0.76]
A little tense/downhearted	Ref group	Ref group
Sometimes tense/downhearted	-0.262	0.098
	[3.2]**	[0.75]
Most of time tense/downhearted	-0.145	-0.470
	[0.73]	[1.63]
All the time tense/downhearted	0.654	-0.888
	[0.92]	[0.93]
No physical and emotional limitation	Ref group	Ref group
Physical limitation	-0.079	-0.128
	[0.61]	[0.64]

Emotional limitation	-0.519	0.603
	[3.47]**	[2.19]*
Physical and emotional limitation	-0.082	0.138
	[0.43]	[0.47]
Practice list size	-0.028	
	[2.14]*	
Training practice	0.485	
	[5.22]**	
Proportion of GPs over 60	-0.886	
	[3.83]**	
Private access	-2.413	
	[1.98]*	
Inward Migration	2.636	
	[1.12]	
Disability allowance	0.003	
	[1.58]	
Bedrofluazide 2.5mg/5mg	0.005	
	[2.38]*	
Angina care score	0.031	
	[4.27]**	
Percentage female GPs	-0.376	
	[2.8]**	
Minor surgery practice	0.244	
	[1.87]	
Percentage non-university graduate	0.014	
	[1.22]	
Health Authority 1	0.232	-0.266
	[0.85]	[0.91]
Health Authority 2	0.724	-0.189
	[1.17]	[0.78]
Health Authority 3	Ref group	Ref group
Health Authority 4	0.418	0.222
	[1.4]	[0.66]
Health Authority 5	-0.070	0.435
	[0.3]	[1.61]
Health Authority 6	0.418	-0.582
	[1.86]	[1.91]
Observations	4280	
Robust z statistics in brackets		
* significant at 5%; ** significant at 1%		
AIC: Interaction model	12349.761	
AIC: Restricted model	12301.613	
Wald test of interaction effects	chi2(47) = 185.41	
	Prob > chi2 = 0.000	

Table 8. Effects of fundholding on satisfaction by wave of fundholding: ordered logit estimates

FH Wave	Effect of fundholding	Distribution of practices		Distribution of patients	
		Number of practices	Percentage	Number of patients	Percentage
1991 FH	-0.578 [3.86]**	4	6.67	264	6.12
1992 FH	-0.481 [1.63]	1	1.67	61	1.41
1993 FH	-0.400 [2.3]*	5	8.33	411	9.53
1994 FH	-0.064 [0.26]	4	6.67	342	7.93
1995 FH	-0.125 [1.16]	2	3.33	172	3.99
1996 FH	-0.392 [2.75]**	5	8.33	384	8.91
1997 FH	-0.232 [1.12]	4	6.67	198	4.59
All FHs	-0.176 [2.357]*	25	41.67	1832	42.5
NFHs		35	58.33	2479	57.5

Joint test FH waves – all FHs.
chi2(7) = 18.44
Prob > chi2 = 0.01
Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 9. Estimated effects of fundholding on patient satisfaction allowing for multiple imputation and survey non-response

Multiple imputation		Survey non-response	
OLS	Ordered logistic	OLS	Ordered logistic
-0.178	-0.299	-0.164	-0.271
[-2.37]*	[-2.27]*	[-2.16]*	[-1.99]*

Robust t statistics in brackets

* significant at 5%; ** significant at 1%