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**PAPER PRESENTED TO 72<sup>ND</sup> HEALTH ECONOMISTS' STUDY GROUP MEETING,  
UNIVERSITY OF EAST ANGLIA, 9-11 JANUARY 2008**

## **Who were the marginal patients under GP fundholding?**

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### **Abstract**

It is thought that GPs weigh up perceived costs and benefits when deciding whether to refer individual patients for specialist care. There will be some individuals for which this decision is marginal. Previous studies have identified that GPs reduced the volume of patient referrals when participating in the fundholding scheme, under which they held budgets for elective care and could reinvest any savings they made. Such studies have identified an aggregate effect but have not been able to analyse whether referrals were reduced for patients with particular characteristics. We follow the admission histories of over 14,000 individuals over the period 1989-2001 using a unique dataset involving the linkage of a detailed health survey to administrative NHS records. Like previous practice-level analyses, we identify that admission probabilities were reduced significantly when the practices that individuals were registered with participated in fundholding. We find that this effect does not vary significantly across individuals stratified by gender, age, health status, education and socioeconomic status. Initial analysis of the fundholding experiment in Scotland does not therefore reveal any obvious characterisation of the marginal patient.

### **Acknowledgements**

We are grateful to Andrew Elders and David Clark at Information Services, NHS National Services Scotland for providing the data used in this paper. HERU receives funding from the Chief Scientist Office of the Scottish Government Health Directorate General and the University of Aberdeen. The authors are responsible for the views expressed.

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## 1. Introduction

There is enduring interest in the factors that GPs take into account when deciding whether to refer individuals for specialist care. Such decision-making processes influence the level of health care expenditure, the equity with which available resources are distributed across different population groups and are a defining feature of the UK National Health Service. In addition, studying such decisions can reveal the nature of the doctor's role as the patient's agent and the potential importance of altruism for these outcomes.

Health care reforms that influence the factors that GPs take into account in referral decisions are a potentially fruitful opportunity for studying these decisions. During the 1990s the UK Government experimented with a fundholding scheme, under which general practices held budgets for elective admissions and could reinvest savings into other services. Dusheiko et al (2006) have modelled this reform as adding an additional element into the GP's referral decision.

The existing evidence suggests that fundholders increased their referrals prior to joining the scheme (to maximise the budget they would receive since it was set on an historical basis; Croxson et al, 2002), decreased their referrals during the scheme (Gravelle et al, 2000) and increased them again when the scheme was abolished (Dusheiko et al, 2006). This provides strong evidence that the potential to make financial savings is a significant factor in referral decisions.

However, constrained by data availability, all of the existing studies could identify only an aggregate effect. They have not identified which types of referrals were reduced, nor which types of patients were not referred, nor whether fundholding reduced admission probabilities or the number of admissions for those admitted at least once.

In this paper we make use of a unique dataset constructed by linking individual health survey records to individual admission histories and general practice characteristics. We examine admission probabilities throughout the period 1989-2001 and confirm that individuals registered with practices participating in fundholding had significantly lower admission probabilities. We then examine whether this 'treatment effect' is heterogeneous with respect to a range of personal characteristics.

At this stage the work is essentially descriptive but development of such an examination of fundholding has the potential to add to a number of important questions:

- Was fundholding an inequitable reform?
- What is the role of the GP as gatekeeper in influencing health care equity?
- Is GPs' altruism 'blind' with respect to patient characteristics?

The paper is structured as follows. In the next section we describe the dataset and, following this, the methods of analysis that we have adopted. The penultimate section contains a summary of the results and the final section offers concluding remarks.

## **2. Data**

### *2.1: Data sources*

Data for this study were collated from three main sources: (i) a health survey; (ii) administrative records of health events; and (iii) general practice databases.

We analyse the cohort of individuals that responded to the 1995 and 1998 Scottish Health Surveys. These surveys contain a wide range of information on several aspects of the health of respondents and their socio-economic characteristics. There were 7,363 individuals in the 1995 survey, aged 16-64 years at the time of the survey, who consented to linkage of their survey records to administrative data. There were 8,305 individuals in the 1998 survey, aged 16-74 years at the time of the survey, who consented to linkage of their survey records to administrative data.

These individuals were probabilistically linked to administrative records held by the central NHS information agency (Information Services, NHS National Services Scotland). These administrative records include admissions to Scottish hospitals, death records and Scottish general practice registrations.

For most respondents we have details of the general practice with which they were registered at the time of the survey or soon thereafter. We linked this to a database giving each practice's fundholding status between 1992 and 1999. We also linked it to a database of the characteristics of general practices. We extracted four variables from this database as at October 1999 (the

earliest year available): the average age of General Practitioners; the proportion of General Practitioners who are female; the total registered population; and the total number of GP Partners.

## *2.2: Selection of sample*

We seek to analyse admissions data for 13 financial years (1<sup>st</sup> April 1989 – 31<sup>st</sup> March 2002) for each of the survey respondents. This covers the period of fundholding, plus two years before its introduction and two years after its abolition. Causes of measurement error in the admissions data are in-migration after the beginning of the study period but before the survey date and out-migration after the survey date but before the end of the study period. From general practice registrations we can identify individuals that are no longer registered with a general practice in Scotland, though the date of last de-registration is not recorded or unreliable. We excluded 855 individuals that had no general practice registration by April 2004, assuming these had migrated out of Scotland following participation in the survey. We also excluded the 340 individuals who died before 1<sup>st</sup> April 2001. Thus, we try as far as possible to ensure an accurately-defined, perfectly-balanced panel.

## *2.2: Description of variables*

### *2.2.1 Admission probabilities*

Standard fundholders were charged for a subset of elective admissions but not for emergency admissions. For each respondent we have a count of the number of elective episodes of hospital treatment but no information on whether these were chargeable under the fundholding scheme. Since GPs are more likely to influence whether an individual patient has an admission rather than the number of admissions, we analyse a binary variable indicating whether or not the individual had an elective admission to hospital in that financial year.

### *2.2.2: Fundholding status*

Practices could apply to become fundholders at different times during the fundholding scheme. Previous studies have identified that early wave fundholders reacted more substantially to the introduction (Gravelle et al, 2000) and subsequent abolition of the scheme (Dusheiko et al, 2006), and we found a similar result in our preliminary analysis. For the purpose of this paper therefore, fundholders were defined as those that had become fundholders before April 1996.

### *2.2.3: Practice characteristics*

The practice characteristics we included were the number of partners in the practice, the average age of the GPs in the practice, the proportion of partners who were female, and the total practice list size.

### *2.2.4: Personal characteristics*

From the survey we used the following personal characteristics: gender; self-assessed general health status; whether the individual reported a longstanding illness; whether the individual was born outside the UK; and the attainment of further or higher educational qualifications. We also made use of a number of household variables intended to reflect the individual's socioeconomic circumstances: whether the household has access to a private car or van; whether the household has central heating; and whether the accommodation is rented rather than owned.

Summary statistics for each of the variables are given in Table 1.

## **3. Method**

### *3.1 Differences in the characteristics of patients and practices by fundholding status*

We begin by examining whether the characteristics of patients and practices differed between fundholders and non-fundholders. We compare mean values of each of the variables by whether or not the practice had become a fundholder before 1996. This contributes to studies of differences between the two groups in case-mix but, since it represents patient registrations at fixed points in time, does not identify cream-skimming behaviour.

### *3.2: Analysis of trends in elective admissions*

We then present analysis of trends in the mean probabilities of admission over time. We plot the series for two fixed cohorts of patients – those registered with practices that become fundholders before 1996 (ever-fundholders) and those registered with practices that do not become fundholders or that become fundholders in or after 1996 (never-fundholders). We have distinguished these series by each of the patient characteristics that we consider in the later analysis but present the charts only stratified by whether the individuals reported a longstanding illness at the time of the surveys.

### 3.3: The effects of fundholding on elective admissions

We estimate models with the basic form:

$$admission_{ijt} = \beta_0 + year_t + \beta_1 earlyfh_j * FH_t + X' \alpha + e_{ijt} \quad (1)$$

in which the dependent variable is the binary indicator of admission for the  $i$ th individual registered with practice  $j$  at time  $t$ . The time trend is captured by a series of year dummies. The effect of fundholding is captured by a variable indicating that the individual is registered with a practice that becomes a fundholder before 1996 ( $earlyfh_j$ ) interacted with a variable that indicates that the fundholding scheme was in place in that year ( $FH_t$ ).

The vector  $X$  represents other time-invariant patient or practice characteristics. We compare models with (1) no additional  $X$  variables, (2) individual characteristics only, (3) practice characteristics only and (4) both individual and practice characteristics.

All models are estimated using a random-effects probit specification ( $xtprobit$ ) using STATA v10.

### 3.4: The effects of fundholding and personal characteristics on elective admissions

In the final models we extend equation (1) to include interactions between the fundholding variable and each of a series of individual characteristics:

$$admission_{ijt} = \alpha_0 + year_t + \delta_0 earlyfh_j * FH_t + \alpha X_{it} + \delta_1 earlyfh_j * FH_t * X_{it} + e_{ijt} \quad (2)$$

The coefficients on the interaction term  $\delta_l$  are of principal interest. They measure whether there is a differential effect of fundholding on the elective admission probabilities of persons with characteristic  $X$ .

## 4. Results

### 4.1 Differences in the characteristics of patients and practices by fundholding status

The mean characteristics of individuals and practices are shown in Table 2. Individuals registered with fundholders were less likely to report a longstanding illness, less likely to rent their homes

and more likely to have access to a car or van. Fundholding practices were larger both in terms of total list size (an initial requirement of the scheme) and numbers of partners.

#### *4.2: Analysis of trends in elective admissions*

Figure 1 compares the mean elective admission probabilities between never-fundholders and ever-fundholders. The vertical lines divide the period under consideration (1989-2001) into three segments. The first, second and third segments indicate the pre-fundholding, the GP fundholding period, and the post-fundholding period, respectively.

As the figure shows, there is an upward trend in elective admissions overtime, up to 2000 when admission begins to decline, irrespective of whether practices are ever or never fundholders. However, elective admissions appear to have been generally lower for ever-fundholder practices relative to practices that were never (or late) fundholders. An interesting pattern emerges when elective admissions between the two practice groups are compared across the three periods. There are no clear differences in elective admissions between them in the pre-fundholding and post-fundholding periods. The differences become clearer in the fundholding period, as the gap in elective admissions between the two groups of individuals widens significantly. The gap closes in the immediate years following abolition of the fundholding scheme, which corresponds to the beginning of the PCT budgetary regime.

In Figures 2 and 3 we present similar charts for those who reported no longstanding illness and those who reported a longstanding illness at the time of the surveys, respectively. In both charts there is some evidence of the same gap emerging between individuals registered with ever and never fundholders during the fundholding period. Visually, it appears that the effect is more marked for those reporting a longstanding illness, though we will go on to test this formally in section 4.4.

#### *4.3: The effects of fundholding on elective admissions*

The estimated models are shown in Table 3. Model (1) contains only the year dummies and the fundholding variable. The coefficient on each of the year dummy variables is positive and significantly different from the base year, 1989. The fundholding variable is negative and statistically significant at 1% level. The results suggest that early wave fundholding practices reduced elective admissions significantly during the fundholding scheme.

In Model (2), individual characteristics are added. The magnitudes of the coefficients on the year dummies are reduced, indicating that some of the cause of rising admission probabilities is the ageing of the cohort. Most of the individual characteristics are significantly associated with the admission probability. Individuals with a longstanding illness and individuals reporting worse self-assessed health (compared to the reference category – “very good”) have significantly higher probability of elective admission. Two of the indicators of better household socio-economic circumstances, central heating and car ownership, are associated with a higher probability of admission. Individuals with further or higher education qualifications are less likely to have an elective hospital admission. The negative effect of fundholding remains negative and significant.

Model (3) represents Model (1) with the addition of practice characteristics. Individuals registered with practices with older GPs and a greater proportion of female GPs are less likely to have an elective admission. The negative effect of fundholding remains negative and significant.

The results of the regression containing both individual and practice characteristics are shown as Model (4). The effect of fundholding remains negative but is not statistically significant at 5% ( $p=0.057$ ). Inclusion of the individual characteristics also renders the coefficient on the proportion of female GPs insignificant at the 5% level.

#### *4.4: The effects of fundholding and personal characteristics on elective admissions*

Table 4 shows the results of adding an interaction term between each of a range of individual characteristics and fundholding into Model (2). In no case is the interaction term significant at the 5% level.

## **5. Concluding remarks**

Our initial investigations have provided no obvious categorisation of ‘the marginal patient’ under the Scottish fundholding scheme. In future work we plan to extend the analysis, and improve the quality of the dataset and the econometric method.

Currently we have analysed the proportion of individuals with at least one elective admission. We plan to extend this analysis to the number of elective admissions using count data regression models. We also plan to refine the dependent variable by distinguishing those elective admissions for which fundholders were charged. Using aggregate data on practice admissions, we can also



examine marginal ‘activities’ rather than ‘patients’ by examining admissions to particular specialties and for particular elective procedures (Propper et al, 2002).

Currently, we exclude individuals that die between the survey date and the end of the study period. This provides a balanced panel but may introduce selection bias. We will experiment with including observations for individuals that are known to have died during the study period. We have also excluded individuals whose registration records indicate migration out of Scotland by April 2004. We will test the importance of this exclusion. Finally, we have assumed that individuals remain registered with the same practice throughout the study period. We will seek further information on the registration histories of particular individuals.

Our econometric approach allows for individual, time-invariant random effects but does not fully account for the dynamic nature of the dataset. We will consider dynamic specifications in future analyses. Our approach has also tested whether practices that choose to participate in fundholding differ on a small number of observable characteristics. We will consider the potential for selection bias (Dusheiko et al, 2004) more fully in future work. Finally, we have presented coefficients from the random-effects models rather than marginal effects. Marginal effects from some of the simpler models indicate that the fundholding effect is of a similar magnitude to that which has been estimated in earlier papers. We will calculate and present marginal effects in future versions of this paper.

## 6. References

Croxson, B., C. Propper, and A. Perkins (2001), ‘Do Doctors Respond to Financial Incentives? UK Family Doctors and the GP Fundholding Scheme’, *Journal of Public Economics*, Vol. 79, (2), pp. 375-398.

Dusheiko, M., H. Gravelle, R. Jacobs, P. Smith (2006), ‘The Effect of Financial Incentives on Gatekeeping Doctors: Evidence from a Natural Experiment’ *Journal of Health Economics*; 25: 449-478.

Dusheiko, M., H. Gravelle, and R. Jacobs (2004), ‘The Effect of Practice Budgets on Patient Waiting Times: allowing for selection bias’, *Health Economics*, 13, pp. 941-958.

Propper, C., B. Croxson, and A. Shearer (2002), ‘Waiting times for hospital admissions: the impact of GP fundholding’, *Journal of Health Economics*, 21, pp. 227-252.

Gravelle, H., M. Dusheiko, and M. Sutton (2000), ‘Rationing by Time, Distance and Money in the NHS: Variations in Admission Rates’, *CHE Technical Paper Series 17*, Department of Economics, University of York.

**Table 1 Descriptive statistics**

Variable	Obs	Mean	St.Dev.	Min	Max
Elective admission in year (1=Yes)	188149	0.079	0.269	0.000	1.000
Registered with fundholder & during scheme (1=Yes)	185198	0.069	0.253	0.000	1.000
Female	188149	0.561	0.496	0.000	1.000
Age (years/100)	188149	0.415	0.151	0.070	0.770
Age2 (year/10,000)	188149	0.194	0.129	0.005	0.593
Age3 (years/1,000,000)	188149	0.100	0.093	0.000	0.457
Female*Age (years/100)	188149	0.233	0.236	0.000	0.770
Female*Age2 (year/10,000)	188149	0.110	0.138	0.000	0.593
Female*Age3 (years/1,000,000)	188149	0.057	0.087	0.000	0.457
<i>Characteristic at time of survey...</i>					
Has longstanding illness	188149	0.400	0.490	0.000	1.000
Self-assessed health="Good"	188149	0.405	0.491	0.000	1.000
Self-assessed health="Fair"	188149	0.187	0.390	0.000	1.000
Self-assessed health="Bad"/"Very bad"	188149	0.057	0.232	0.000	1.000
Non-UK born	188019	0.027	0.161	0.000	1.000
Rents home	188019	0.371	0.483	0.000	1.000
Has central heating	188149	0.903	0.296	0.000	1.000
Access to private car/van	188149	0.720	0.449	0.000	1.000
Further or higher qualification	187863	0.267	0.443	0.000	1.000
<i>Practice characteristic in 1999...</i>					
Number of GP Partners	172939	4.78	2.03	1.00	11.00
Mean age of GPs	172939	43.5	4.5	31.0	68.0
Proportion of female GPs	172939	0.348	0.194	0.000	1.000
Population registered with practice	172939	7094	3396	218	24167

**Table 2 Patient and practice characteristics by fundholder status**

Variable	Never fundholder	Ever fundholder
<i>Individual characteristics</i>		
Female	0.563	0.550
Age	44.4	44.8
Longstanding illness	0.407	0.373
Non-UK born	0.027	0.029
Rents home	0.375	0.345
Central heating	0.902	0.906
Access to car	0.718	0.732
Further/higher education	0.267	0.272
Good SAH	0.404	0.405
Fair SAH	0.188	0.179
Bad/Very Bad SAH	0.059	0.050
<i>Practice characteristics</i>		
Number of GP Partners	4.55	5.85
Mean GP age	43.4	43.8
Female GPs	0.350	0.338
Registered population	6612	9298
N	11,737	2,509

**Table 3 Random-effects probit regression of probability of elective admission**

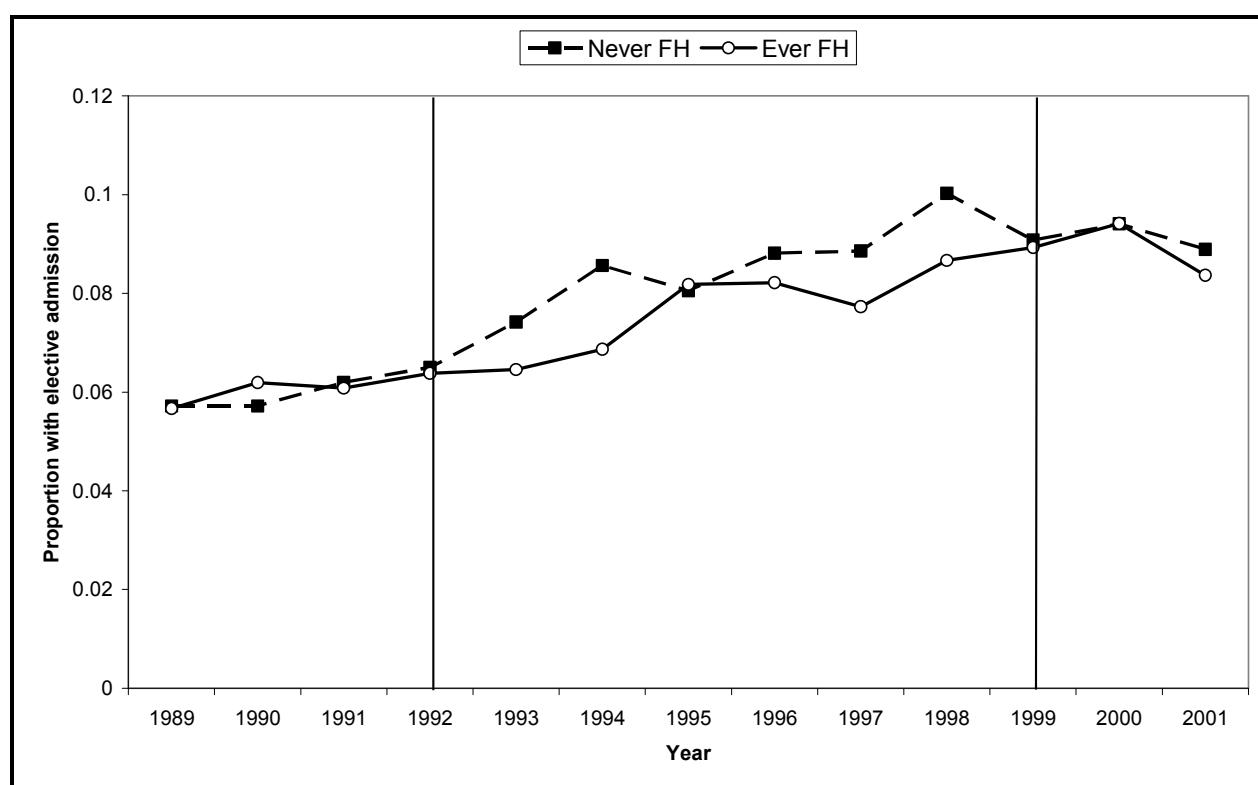
Model	(1)		(2)		(3)		(4)	
Variable	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z
1990	0.007	0.28	0.002	0.08	0.008	0.29	0.002	0.08
1991	0.035	1.34	0.023	0.88	0.027	1.01	0.015	0.55
1992	0.061	2.35	0.038	1.48	0.055	2.05	0.031	1.17
1993	0.138	5.45	0.112	4.38	0.128	4.89	0.101	3.84
1994	0.205	8.17	0.171	6.75	0.199	7.65	0.164	6.26
1995	0.195	7.71	0.154	6.02	0.182	6.92	0.141	5.32
1996	0.234	9.33	0.186	7.33	0.229	8.81	0.182	6.92
1997	0.229	9.12	0.173	6.79	0.219	8.41	0.163	6.16
1998	0.321	12.98	0.257	10.19	0.313	12.25	0.249	9.58
1999	0.262	10.61	0.192	7.60	0.254	9.95	0.183	7.01
2000	0.307	12.55	0.226	8.97	0.304	12.07	0.223	8.58
2001	0.286	11.68	0.197	7.72	0.287	11.32	0.197	7.49
Fundholding	-0.055	-2.50	-0.047	-2.18	-0.046	-2.01	-0.043	-1.91
Female			-0.258	-1.30			-0.215	-1.04
Age			3.955	3.31			4.161	3.34
Age2			-9.648	-3.33			-9.929	-3.28
Age3			8.786	3.98			8.832	3.83
Female*Age			4.573	2.96			4.307	2.68
Female*Age2			-11.149	-2.97			-10.762	-2.76
Female*Age3			7.040	2.47			6.972	2.35
Longstanding illness			0.262	16.85			0.259	16.22
SAH="Good"			0.087	5.39			0.080	4.79
SAH="Fair"			0.214	10.18			0.204	9.42
SAH="Bad"/"Very bad"			0.466	15.48			0.473	15.24
Non-UK born			-0.039	-0.94			-0.049	-1.15
Rents home			-0.029	-1.78			-0.027	-1.67
Central heating			0.070	3.04			0.064	2.73
Access to car			0.064	3.77			0.065	3.76
Education			-0.118	-7.21			-0.120	-7.13
Mean GP age					-0.006	-3.44	-0.005	-3.23
Proportion female GPs					-0.095	-2.40	-0.059	-1.60
Number GP Partners					0.000	0.02	0.000	-0.03
Practice population					0.000	-0.56	0.000	0.09
Constant	-1.815	-91.28	-2.777	-17.75	-1.499	-17.46	-2.551	-14.10
/lnsig2u	-1.083		-1.366		-1.104		-1.390	
sigma_u	0.582		0.505		0.576		0.499	
rho	0.253		0.203		0.249		0.199	
N observations	185198		184782		172939		172549	
N individuals	14246		14214		13303		13273	
Model Log-L	-48281		-47301		-45002		-44100	
LR test (rho=0)	4865.37		3170.55		4419.12		2870.14	

**Table 4 Significance of additional terms in the interaction models**

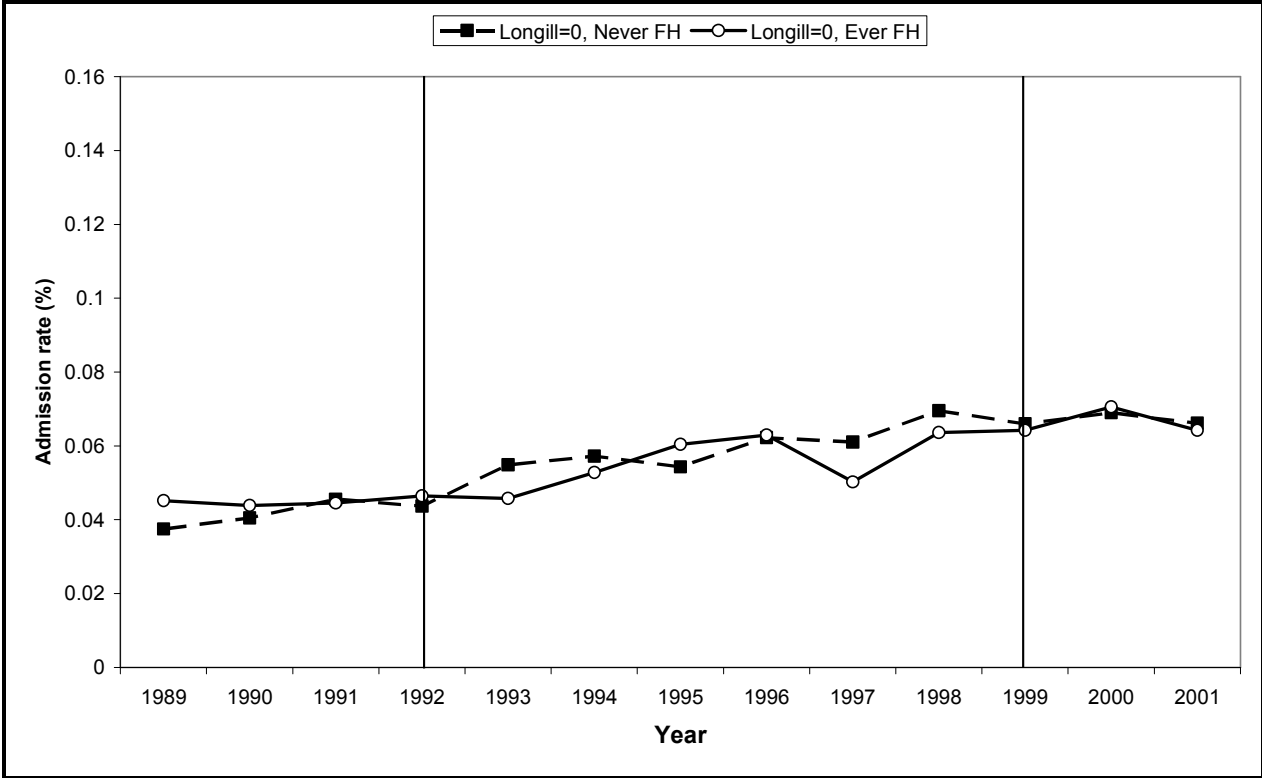
Personal characteristic (X)	Xvar - Main effect		FH - Main effect		Interaction term	
	Coeff	z	Coeff	z	Coeff	z
Aged 60+	0.028	1.10	-0.039	-1.63	-0.043	-0.84
Female	-0.257	-1.29	-0.029	-0.90	-0.032	-0.76
Longstanding illness	0.263	16.66	-0.039	-1.35	-0.018	-0.44
Education	-0.120	-7.21	-0.056	-2.30	0.038	0.79
Car owner	0.060	3.49	-0.091	-2.29	0.061	1.32
Central heating	0.072	3.08	-0.016	-0.24	-0.034	-0.49

Interactions terms are added for each personal characteristic separately into Model (2), Table 3.

**Figure 1 Trends in proportion with at least one elective admission – all individuals**



**Figure 2 Trends in proportion with at least one elective admission – no longstanding illness**



**Figure 3 Trends in proportion with at least one elective admission – has longstanding illness**

