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GP Utilisation in Northern Ireland: Exploiting the Gatekeeper Function*

PAT MCGREGOR, PAT MCKEE, CIARAN O'NEILL
University of Ulster

Abstract: Using data from the Northern Ireland Household Panel survey we demonstrate that attendance at outpatients is determined solely by respondent health. This is consistent with the GP acting as a gatekeeper to other services. Attendance thus provides valuable information on illness severity. Splitting the sample into two statistically distinct groups, we estimate ordered probit regressions of GP utilisation with and without sample selection. The results indicate that ignoring outpatient attendance may result in misspecification. Further, if health is more fully measured, age becomes redundant as a determinant of utilisation and service supply, particularly accident and emergency use, is seen as a significant determinant in explaining GP visits.

I INTRODUCTION

General practitioners (GPs) play a central role in the operation of the UK's National Health Service (NHS) being often both the primary carers and gatekeepers to other diagnostic and specialist services. Unlike in the Republic of Ireland, GP consultations are provided free at the point of use in the NHS to all, no means test being involved. In the absence of a service charge use is constrained by the deterrence associated with extended waiting times. Access to hospital and other medical services (when, for instance, the GP is unable to

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treat or diagnose the patient in the surgery) is generally by GP referral. The GP in this regard acts as a gatekeeper to other parts of the NHS. The two key exceptions to this are emergency admissions to inpatient care and where the patient utilises accident and emergency services (A&E) as an alternative to the GP.

GP services have the potential to significantly impact on the performance of the overall system as well as the experience of the individual patient. They have been shown to be a significant determinant of population health (Macinko *et al.,* 2003; Starfield and Shi, 2002), effective cost containment (Delnoij *et al.,* 2000; Verhaak *et al.,* 2004; Gerdtham *et al.,* 1998) and the promotion of equity objectives (Shi *et al.,* 2003, Starfield, 2004; van Doorslaer *et al.,* 2004). In 2001 some 261 million GP consultations occurred in the UK (Office of Health Economics, 2004) at a cost in GP time alone of £5.22 billion.[1] Given this and its importance to overall system performance it is imperative that a clear understanding exists as to the determinants of GP utilisation.

A considerable amount of research effort has been devoted to this issue. Work by Morris *et al.* (2001), Smith *et al.* (2001), Hammond *et al.* (2004) and the UK Government (Cabinet Office, 2001; 2002), for example, has examined the inappropriate use of GP services in the UK. Studies by Carr-Hill *et al.* (1996); Scaife *et al.* (2000); Field and Briggs (2001) and Adamson *et al.* (2003) have highlighted the role of *inter alia* ethnicity, gender and social class in utilisation while van Doorslaer *et al.* (2004) among others have examined issues regarding equity of access. These and issues such as the impact of charging have also been examined for the Republic of Ireland (Nolan, 1993, 1994; Nolan and Nolan, 2003; Madden *et al.,* 2005) and in other contexts (Scott *et al.,* 2003; Van de Voorde, 2001).

In this paper we use Wave 1 of the Northern Ireland Household Panel survey – a general population survey – to test the operation of a gatekeeper model of outpatient attendance. The principal health information employed consists of self-reported health conditions, such as whether the respondent suffers from diabetes. If the gatekeeper model is valid then attendance at hospital outpatients provides an objective measure of condition severity and this information can be employed in GP utilisation functions; functions where its omission could otherwise cause misspecification bias. The remainder of the paper is developed in four sections. In Section II an intuitive model is presented. In Section III the data used to estimate the parameters of the model are discussed and in Section IV the results of the estimation are presented. In Section V we discuss our findings and provide a brief discussion of their implications. In Section VI we conclude the paper.

[1] Assuming a cost per consultation of £20 in 2001/02 (Netten and Curtis, 2002).

II AN INTUITIVE MODEL OF GP UTILISATION

We postulate that GP visits can be viewed in a similar fashion to any good or service (albeit with particular attributes) and examined within a standard utility maximising framework – an approach not dissimilar to that of other authors (Pohlmeier and Ulrich, 1995). Visits generate utility either directly and/or through the health gains associated with them. Equally they give rise to costs in terms of financial outlays and/or the opportunity costs of time. In determining whether or not to undertake a visit the individual weighs up the expected costs and benefits, undertaking all visits for which benefits exceed costs. In explaining visits then we need only identify and model the factors that contribute to costs or benefits or that allow the individual to identify these.

More formally, let utility be a concave function, $U = U(C, l, V2GP \mid H)$, of the use of GP services, *V2GP,* and the standard arguments consumption, C, and leisure l; this will be conditional upon the health, H, of the individual. If total time available for the individual is X and each unit of GP service takes time t then the budget constraint is:

$$(X - l - tV2GP)\, w + b - pc \geq 0,$$

where w is the wage rate, p is the price of consumption and b is unearned income. Maximising utility subject to the budget constraint gives:

$$\frac{U_C}{p} = \frac{U_l}{w} = \frac{U_{v2GP}}{tw}.$$

tw is the opportunity cost in terms of the wage of attending the GP. The indeterminacy of the income effect means that the effect of an increase in wage on the consumption of GP services can only be established empirically. A similar uncertainty faces the pure income effect in terms of unearned income. It is possible, on the one hand, that the rich are more solicitous concerning their own health and thus consume more GP services or, on the other hand, that the consumption of additional goods and services might ameliorate the discomfort of the health condition leading to reduced consumption of GP services.

The utility function is conditional upon health and should this decline it would be anticipated in general that there would be increased consumption of GP services by the individual (this would be greatest where the condition was chronic and only palliative care was indicated). However, as the name "general" suggests, the GP delivers primary care and in situations where

specialist treatment or investigation is warranted the patient is usually referred to hospital. This step may not be determined entirely by the health of the patient but may also be influenced by how forceful, articulate or informed he/she is or their expectations of the service. Expectations themselves are based on information that will not be uniformly distributed across the population: in general though information would be anticipated to be positively correlated with education.[2]

Attendance at outpatients (V2OP) may be modelled using a linear latent index. The general model is:

$$V2OP^*_i = \sum_{j=1}^{m} \alpha_j SRC_{jt} + \sum_{k=1}^{n} \beta_k SOCECON_{ki} + \varepsilon_i,$$

where if $V2OP^* \geq 1$ then the individual visits outpatients following GP referral and $V2OP = 1$. The SRC_j are self-reported health indicators and the $SOCECON_k$ are socio-economic variables that may influence the individual in visiting outpatients. The link between the socio-economic variables and the information, expectations and powers of advocacy of the patient are not precise and this suggests that the initial choice of variables explaining this should not be overly discriminating. Should the GP be an effective gatekeeper then only clinical criteria should be employed for referring a patient to outpatients and all the β_k should not be statistically different to zero.

The local supply of medical services, both GP and hospital, may also exert an influence on GP utilisation. Where hospital services are not conveniently located, it is possible that GP surgeries may assume greater responsibility for patient welfare, as in the provision of clinics for particular conditions. Similarly, if the number of GPs available in an area increases, so too may availability and use. In contrast to this, a decline in GP numbers reduces availability and may encourage the use of substitute services such as accident and emergency.

III DATA

In examining utilisation a number of studies have deployed data collected from general population surveys. Examples here include Madden *et al.'s* (2005) and Nolans' studies in the Republic of Ireland (Nolan, 1993, 1994; Nolan and

[2] Expectations may be in error in the sense that the individual may over or underestimate costs or benefits. In the case of asymptomatic illness, for example, the individual may because of ignorance underestimate the benefits of a visit. This possibility is not unique to family practitioner consultations in health care (Pauly, 1978) though it has been argued that the extent to which it is present here will be less than in other aspects of care (Pauly, 1988).

Nolan 2003) and Dunlop *et al.*'s studies in Canada (Dunlop *et al.,* 2000). These inevitably face limitations associated with the design of surveys for general use. Such surveys, for example, do not allow the researcher to readily relate GP visits to specific conditions or to distinguish between GP initiated and user initiated visits. Similarly, in measuring ill health they are obliged to rely on self-reported measures rather than those confirmed by clinical diagnoses. While these limitations exist, they are mitigated by the broader and more detailed range of information available on respondents' circumstances that are contained in these surveys. This information may allow a more complete picture of the individual to be obtained than is possible from more narrowly focused health surveys. In examining non-users as well as users moreover they afford the opportunity to compile a detailed picture for both groups avoiding issues of selection bias that might arise when using data from GP clinic-based surveys. Nolan (1993, 1994); Nolan and Nolan (2003); Madden *et al.,* (2005) and Dunlop *et al.,* (2000) deploy such data to examine GP use. Others have used it to explore issues such as the determinants of health (Bartley *et al.,* 2004; Brimblecombe, 1999) health inequalities (van Doorslaer, 2004; Hirst, 2003) and smoking behaviour (Twigg, 1999).

For this study data were extracted from the first wave of the Northern Ireland Household Panel Survey (NIHPS), an extension of the British Household Panel Survey (BHPS). In addition to questions on household (income, size, composition) and individual characteristics (age, education, gender), the survey identifies utilisation of various health services that include GP and outpatient consultations. The sample consisted of 2,000 households containing 3,500 individuals. Households were drawn on the basis of a stratified random sample from across Northern Ireland. On key demographic characteristics the survey has been shown to provide a representative sample of the Northern Ireland population (McGregor *et al.,* 2003). All responses (including those relating to health conditions) were self-reported and relate to the calendar year 2000 – data being collected in 2001.

In addition to information on GP utilisation, three types of data were extracted from the survey: first, data relating to individual health, such as self-reported conditions; second, data other than health that may affect the costs or benefits associated with a GP visit, such as employment status (thus individuals in employment will face greater demands on their time than the retired and likely face greater opportunity costs in consequence) and third, data related to the individual's information set, here proxied using their highest educational attainment. The full range of variables extracted is presented in Appendix 1.

GP and outpatient visits are both specified in the survey as categorical variables, categories being zero visits, 1-2 visits in the past 12 months, 3-5,

6-10 and more than 10 in the past 12 months. To estimate mean visits we identified the class mark for each group, assuming a class mark of 12 for the category more than 10.

In respect of health, respondents were asked to indicate which of a series of conditions, excluding temporary ones, they suffered. Self-Reported Conditions (*SRC*s) were specified as a series of categories. Amongst respondents, 14 stated explicitly the part of the body affected or a particular medical condition and a 15th ("other") allowed the respondent to write in any problem not explicitly mentioned. Named conditions included broad groupings such as "arms/legs etc" and "heart/blood" as well as more specific conditions such as "diabetes" and "epilepsy". The survey did not limit the number of conditions reported. In addition, the individual could report whether or not s/he had experienced an accident, was disabled or had had a baby in the past 12 months (the latter applying only to females).

IV ESTIMATION AND RESULTS

Descriptive statistics for the various variables are presented in Table 1. The income variable employed was annual equivalised income – that is household income adjusted for demographic composition. Each individual in the household is assigned the equivalised income, so each member of the household has the same income irrespective of their employment status. Equivalised income thus provides an indicator of the household's welfare. The potential lost earnings associated with time off work in arranging/undertaking an appointment was captured by individual monthly earnings and hours worked.

In Northern Ireland health services are organised into four regions. The health board that each individual resides in was identified by the Northern Ireland Statistical Research Agency and made available to us. Information on the population size, number of GPs and number of accident and emergency episodes in each of the four regions was obtained from the Department of Health Social Services and Public Safety for Northern Ireland.

Normally a Poisson or related regression would be employed with count data such as GP visits (Cameron and Trivedi, 1998). However, the grouping of the data in this instance made use of this approach particularly cumbersome so an ordered probit was used instead. Health is viewed as the principal determinant of benefits associated with a GP visit. To reflect its multidimensional nature it was specified using several variables. The basic data comprised 15 self-reported chronic conditions. (The potential for endogeneity where limiting long-term illness is the sole measure of health

Table 1: *Descriptive Statistics*

Variable		*Variable*	
UTILISATION	*Mean*	*INCOME*	*Mean*
VISITS TO GP		EARN Mean	661.15
(SD)	1.75	(SD)	(999.46)
	(3.02)		
VISITS TO OUTPATIENTS		HOURS Mean	15.63
(SD)	3.77	(SD)	(18.21)
	(3.81)		
HEALTH		*PHYSICAL*	
MORB		AGE	
(SD)	1.22	(SD)	1.15
	(1.39)		(0.45)
			Proportion
SELF REPORTED		Male	0.42
CONDITIONS	*Proportion*		
ARMS	0.23	*SOCIO-ECONOMIC*	*Proportion*
CANCER	0.01	INACT	0.43
CHEST	0.11	UNEMPLOY	0.05
DEPRESSION	0.09	CATHOLIC	0.39
DIABETES	0.03	COUPDEP	0.34
DRUG	0.01	COUPNDEP	0.12
EPILEPSY	0.01	LONEPAR	0.06
HEARING	0.07	SINGLEE	0.07
HEART	0.17	SINGLE	0.08
MIGRAINE	0.07	FAMILY CARER	0.11
OTHER	0.02	GRAMMAR	0.24
SIGHT	0.04	DEGREE	0.10
SKIN	0.08	VOCQUAL	0.38
STOMACH	0.09	ALEVEL	0.14
STROKE	0.04	OLEVEL	0.26
		OWNER	0.73
OTHER HEALTH		RETIRED	0.20
ACCIDENT	0.11	SMOKER	0.29
DISABLE	0.09	N = 3,203	
HADBABY	0.02		

Sources: Northern Ireland Household Panel Survey Wave 1, 2001.

used to explain utilisation has been discussed by Sutton *et al.* (1999). The potential for bias is much reduced with BHPS data where self-reported conditions are chronic and both these and visits relate to an extended time period – a year compared to a single month in Sutton.)[3] In addition to these

[3] In that case (Equation 2 of Sutton) physical measures of health, such as blood pressure, respond to treatment provided in visits; such simultaneity would not arise in chronic conditions to any appreciable extent with the possible exception of diagnosis.

the individual also reported if they had had a baby (*HADBABY*) or an accident (*ACCIDENT*) in the past 12 months, was registered disabled (*DISABLE)* or had visited an outpatients department. For simplicity, a single index measuring health would be preferable to a series of dummy variables. However, simply summing conditions to generate one would imply an equal weight for each condition and ignore the severity of individual conditions. Clearly this would be erroneous. A composite health variable (*MORB*) was specified as the sum of the various self-reported conditions detailed above.

$$MORB_i = \sum_{k=1} SRC_{ik} \ .$$

The data were allowed to adjust the weight attached to individual conditions by the inclusion of separate dummy variables (where *ARMS* is dropped from these to avoid a linear relationship with *MORB*).[4] Epilepsy was combined with *OTHER* due to the small number affected. In addition, the composite health variable was entered into the index function of the ordered probit as a quadratic to take account of possible nonlinearities in its relationship with use of services.

$$-\text{Health}_i = \sum_{k=1}^{K} \lambda_k SRC_k + \lambda_{K+1} HADBABY_i + \lambda_{K+2} ACCIDENT_i + \lambda_{K+3} DISABLE_i + \lambda_{K+4} MORB_i + \lambda_{K+5} MORB_i^2$$

In addition to *SRCs* attendance at outpatients provides further potentially useful information on the state of an individual's health if the gatekeeper model of referral is valid. Access to outpatients in the UK is normally by referral from a GP, the GP acting as a gatekeeper to these services. According to this model only individuals whose condition in the opinion of the GP is sufficiently severe or complex to warrant specialist treatment or diagnosis are referred to outpatients. *Ceteris paribus*, it follows, that individuals attending outpatients are likely to have poorer health/more complex needs than those who do not (evidence from other studies supports this assertion (Bowling and Redfern, 2000)).

[4] The coefficient of a particular *SRC*, k is thus $\lambda_k + \lambda_{K+4} + 2\lambda_{K+5}\left(\sum SRC_j\right)$; since λ_k is specific to the particular *SRC* its overall weight in *–Health* is determined by the data.

Table 2: *Differences Between Attenders and Non-attenders*

	Non-Attenders	*Attenders*	*P-Value*
MORB	0.69	1.56	0.00
GP VISITS	1.13	2.21	0.00
EQUIVLISED HOUSEHOLD INCOME	20.29	19.45	0.13

N = 3,203.

Table 2 shows that those attending outpatients (attenders) on average have a higher value of *MORB* and also visit the GP more frequently. These health-related differences are statistically significant whereas others such as income are not. A gatekeeper model implies that only health should determine attendance at outpatients.[5] This was tested using a probit function the results of which are reported in Table 3. The unrestricted model consisted of health and a wide range of socio-economic and demographic variables. The function included 25 non-health related variables. As can be seen from Table 3, only one of these variables, *SMOKER* was significant, and this only at the 10 per cent level. The variables *NORTH, SOUTH* and *WEST* are dummies indicating the health region in which the individual resided. Their insignificance indicates that there are no major variations in use of outpatient services at a health board level. A likelihood ratio test was run on the null hypothesis that the coefficients of the non-health variables were jointly equal to zero. The statistic is distributed as a chi-squared variable with 25 degrees of freedom. The test statistic was 22.93 (the critical value associated with the 5 per cent significance level is 37.65); therefore, the null hypothesis that the coefficients of the non-health variables equalled zero was not rejected. Thus attendance at outpatients is explained solely by health and so can be used as an indicator thereof.

The operation of a gatekeeper model does not necessarily imply that the coefficients of a latent index explaining GP visits for attenders and non-attenders are the same – that is, that only a single model need be applied to the data. Consequently, a saturated model where an extensive number of potential explanatory variables (55 in total, including 10 decile dummies) appeared was estimated for attenders and non-attenders as well as for the two groups combined. The resulting log likelihoods are given in Table 4 from which the likelihood ratio statistic of 355.69 is derived. The critical value for a chi-

[5] Attendance is distinct from referral, however, studies indicate that the role of variables other than health while significant is small (Hamilton *et al.,* 2002).

Table 3: *Probits Analysis of Outpatient Visits*

	Unrestricted		*Restricted*			*Unrestricted*	*Restricted*
Constant	–0.9253	**	–0.6952	***	OWNER	–0.0339	
MORB	0.5372	***	0.5809	***	LONEPAR	–0.0307	
MORBSQ	–0.0459	***	–0.0487	***	COUPDEP	–0.0784	
SIGHT	–0.1549		–0.1809		COUPNDEP	0.0717	
HEAR	–0.2886	**	–0.2969	**	SINGLEE	–0.0598	
SKIN	–0.2968	***	–0.3400	***	SINGLE	0.1219	
CHEST	–0.1616		–0.1957	**	DEGREE	0.0132	
HEART	–0.0586		–0.0412		PDEGREE	0.0453	
STOMACH	0.2072	*	0.1998	*	ALEVEL	–0.0341	
DIAB	0.5292	***	0.5096	***	OLEVEL	0.0385	
DEP	–0.1067		–0.1060		VOCQUAL	0.0771	
DRUG	–0.5946	*	–0.5589	*	AGE	0.5225	
MIGRAINE	–0.1477		–0.1816		AGESQ	–0.3745	
CANCER	–0.1483		–0.1784		AGECUB	0.0834	
STROKE	0.2220		0.1955		SMOKER	–0.1048	*
					MALE	–0.0468	
OTHER	1.2949	***	1.2974	***	CATHOLIC	0.0086	
ACCIDENT	0.8648	***	0.8401	***	NORTH	0.0142	
HADBABY	1.1718	***	1.1908	***	SOUTH	0.0482	
DISABLE	0.2608	***	0.2761	***	WEST	–0.0590	
INACT	0.1199				CAR	0.0488	
RETIRED	0.0283						
UNEMPLOY	–0.0372				N	3,203	3,203
GRAMMAR	–0.0341				Log-likelihood	–1,866.108	–1,877.571

***indicates significant at 1 per cent level.
** indicates significant at 5 per cent level.
* indicates significant at 10 per cent level.

squared with 55 degrees of freedom at the 5 per cent significance level is 73.31 so equality of coefficients is decisively rejected. Thus the GP utilisation models for attenders and non-attenders are statistically different.

Separate ordered probits were run for attenders and non-attenders and were pruned by removing all variables with a t-ratio of less than 1 (confirming with a Wald test that the coefficients were simultaneously equal to zero). The results of re-estimating these models are given in columns 2 and 4 of Table 5. While the gatekeeper model performs well, it is unlikely that the relatively crude measures of health and individual characteristics that are available in the survey fully take account of individual variation. Consequently, it is possible that errors in the index functions of the outpatient and the GP utilisation models may be correlated. In columns 1 and 3 of Table 5 the results allowing for sample selection are presented. The correlation coefficient ρ is

significant in both cases, negative with respect to attenders and positive with respect to non-attenders.

Table 4: *Log Likelihoods of Saturated Models*

Model	*Log likelihood*	*N*
Combined	–4,192.83	3,203
Attenders	–1,925.87	1,448
Non-attenders	–2,089.12	1,755

V DISCUSSION

The results produced in Table 3 are consistent with the operation of a gatekeeper model for the use of outpatient services. As such they contradict the European evidence produced by van Doorslaer *et al.* (2004) that inequality in use of specialist services is pro-rich whereas that of GP services is frequently pro-poor. The evidence of Table 3 is that in Northern Ireland, health is the sole determinant of attendance at outpatients and thus access to these specialist services is income neutral. Further, attendance at outpatients provides additional information concerning health, neglect of which could lead to mis-specification within the model of GP utilisation and potentially arouse mistaken concern with inequality. This is clearly demonstrated in Table 5 where the separate results for attenders and non-attenders (columns 2 and 4) can be compared to the combined model in column 5. In the combined model individuals with apparently the same health characteristics (i.e., when health is controlled in the function) may exhibit different patterns of GP attendance due to differences in the severity of their health conditions: such heterogeneity seems to be caught by socio-economic variables. While in the combined model, for example, *DECILE*, *EARN*, *CATHOLIC* and *COUPDEP* are significant this is not the case for either attenders or non-attenders when taken separately. In the absence of attendance at outpatients as a distinguishing characteristic, income (or its correlates), either in the form of *EARN* or *DECILE*, appears to adopt an indicator role and may give rise to concern regarding inequality.

Columns (1) and (3) in Table 5 indicate a significant role for sample selection in addition to attendance at outpatients in modelling health. Interpretation of the significant ρ here is straightforward. Consider for example an anxious patient who sees the GP concerning a particular problem. The pressures of general practice are considerable and it is possible that such a patient would be referred to outpatients even if the GP did not believe this

Table 5: *An Ordered Probit Analysis of the Determinants of GP Visits*

Attenders		*Selection*	*Non-Attenders*		*Combined*
with (1)	*without* (2)		*with* (3)	*without* (4)	(5)
–3.7111 **	–6.3910 ***	Constant	–1.3170	–0.9995	–4.0816 ***
	0.3867 ***	MORB	0.5323 ***	0.6612 ***	0.6348 ***
	–0.0298 ***	MORBSQ	–0.0589 ***	–0.0624 ***	–0.0492 ***
	–0.1873	SIGHT	–0.5600 ***	–0.6475 ***	–0.4530 ***
		HEAR	–0.2634 **	–0.3560 **	–0.2923 ***
		SKIN	–0.2140 *	–0.3247 ***	–0.2691 ***
0.3128 ***	0.2168 **	CHEST			0.0722
0.2060 ***	0.2088 **	HEART	0.2559 ***	0.2274 **	0.1412 **
	0.1591 *	STOMACH		–0.2074	
		DIAB			0.1741
0.3746 ***	0.3178 ***	DEP	0.4524 ***	0.4215 ***	0.3050 ***
–0.2874	–0.7346 **	DRUG			–0.5503 **
		MIGRAINE	–0.2053	–0.2736 **	–0.1764 **
0.2830		CANCER			
–0.3976 ***		OTHER			
0.2022 **	0.3560 ***	DISABLE	0.2859 **	0.3381 **	0.3635 ***
–0.3306 ***		ACCIDENT		0.4003 ***	0.3662 ***
	0.7394 ***	HADBABY		0.3623	0.9295 ***
0.0440	0.0733	DECILE	0.0467	0.0497	0.0773 **
–0.0067 **	–0.0102 **	DECSQ	–0.0049	–0.0052	–0.0081 ***
0.2918 ***	0.3688 ***	INACT	0.3704 ***	0.3469 ***	0.2961 ***
–0.2513 ***	–0.2922 ***	RETIRED	–0.1961 **	–0.1627	–0.2729 ***
–0.2911 **	–0.3310 **	UNEMPLOY	–0.1183		–0.1939 *
–0.0871	–0.1101	OWNER			
–0.0599	–0.0759	COUPDEP			–0.1253 ***
–0.2351 ***	–0.2805 ***	COUPNDEP			–0.1829 ***
–0.2192 **	–0.2955 ***	SINGLEE	–0.2437 *	–0.2575 **	–0.2771 ***
		PDEGREE	–0.2631 *	–0.2642 **	
		SMOKER	–0.0671	–0.0753	–0.0637
–0.1007 **	–0.0997	MALE	–0.3615 ***	–0.3836 ***	–0.2340 ***
		CATHOLIC	0.0841	0.0824	0.0726 *
		EARN			–0.0206 *
		CAR	0.0848	0.0920	0.0472
–0.6072 **	–0.7923 **	A&E	–0.7225 **	–0.7366 **	–0.8168 ***
3.3621 ***	4.4582 ***	PATPERGP	0.9729	0.8566	2.7721 ***
0.9969 ***	1.2528 ***	Mu(1)	1.2686 ***	1.3006 ***	1.1965 ***
1.6673 ***	2.1216 ***	Mu(2)	2.0484 ***	2.0999 ***	1.9873 ***
2.2190 ***	2.8344 ***	Mu(3)	2.7821 ***	2.8524 ***	2.6797 ***
–3,809.60	–1,937.15	Log likelihood	–3,985.52	–2,102.94	–4,204.83
–0.8105 ***		ρ	0.2771 **		
3,203	1,448	N	3,203	1,755	3,203

*** indicates significant at 1 per cent level.
** indicates significant at 5 per cent level.
* indicates significant at 10 per cent level.

was warranted; basically the demands of dealing with a difficult case would be transferred. (This remains consistent with a gatekeeper model in which anxiety is viewed as part of health.) If the GP assessment was correct then such a referral may result in less treatment compared with others attending outpatients. Compared with others at the same health level, this patient would visit outpatients but would use less GP services than the average of others who attended outpatients. Thus a positive residual in the index function for outpatient visits may be associated with a negative residual in the GP index function – as is found. The difference in sign of the correlation coefficient between the two ordered probits in Table 5 does not require a different interpretation from the above: it merely reflects the inversion of the selection probit.

Given the above, attention in the remaining discussion is focused upon columns (1) and (3) in Table 5. As one would expect, the health variables play a significant role in determining GP utilisation, though the pattern is different between attenders and non-attenders. This may reflect the distribution of responsibilities between hospital and general practice. For example, chest complaints result in no additional visits (beyond that indicated by *MORB* and *MORBSQ*) to the GP among non-attenders but do among attenders: this suggests that GP and outpatient services are complements in this case.[6] The absence of age as a significant determinant of GP utilisation is notable; normally one would expect health to deteriorate with age and with this use of services to increase. The result here is consistent with recent literature though (Seshamani, 2004) which suggests that health, provided it is adequately measured, rather than age determines health care utilisation.

Clearly the supply of GP services will influence individual utilisation as will the availability of substitutes. To capture the latter, the variable *A&E* was constructed as accident and emergency episodes per head of population. Quantifying the supply of GP services was more problematic. The measure employed was patients per whole-time GP equivalent. In that this ignores population density, practice structure (number of GPs per practice) and availability of support services (community psychiatric, nursing services) etc., it is extremely crude. Any improvement upon this measure would, however, require substantial information and modelling that is not practicable with just four health boards.[7] The negative sign on *A&E* can be readily interpreted as

[6] Each *SRC* appears in *MORB* and so its effect will consist of an average weight attached to *MORB* and a particular adjustment indicated by the *SRC* coefficient. Thus the interpretation of coefficients is complex, in addition to the general point concerning marginal effects in ordered probit models (Greene, 2003, 21.8).

[7] There are just 12 A&E departments in Northern Ireland compared to about 1,100 GPs across 366 practices (Appleby, 2005). The degree of heterogeneity among GPs is consequently much greater.

indicating it is a significant substitute for GP services. The positive sign of *PATPERGP* for attenders compared to its insignificance for non-attenders may reflect measurement error though it is possible to interpret this as evidence that constraints on service result in the ill receiving greater priority.[8]

VI CONCLUSIONS

In this paper we have demonstrated that attendance at outpatients in Northern Ireland can be explained solely in terms of the numerous health conditions reported in the Northern Ireland Household Panel Survey. This is consistent with the operation of the GP as a gatekeeper to other services in the National Health Service. Moreover, it supports the contention that attendance at outpatients provides important information regarding the severity of an individual's health conditions that is central to modelling service use. As we have shown failure to utilise this information in this context results in misspecification and could result in misplaced concern regarding inequality.

The paper has also demonstrated that the more extensive use of information on health – including self reported conditions and attendance at outpatients – renders age redundant as a factor explaining GP use. This may have implications for ongoing debates regarding morbidity compression, population ageing and health care expenditures.

Finally, we have demonstrated the importance of including aspects of service supply in modelling utilisation of GP services. In Northern Ireland, concern has recently been expressed regarding the inappropriate use of A&E as a substitute to GP services (Appleby, 2005). This paper lends statistical support to this contention and suggests this may be a fruitful area for further research.

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[8] Examination of marginal effects fails to affect the conclusions.

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APPENDIX 1
DEFINITION OF VARIABLES

HEALTH	
MORB	The sum of self reported conditions, *HADBABY* and *ACCIDENT*.
MORBSQ	MORB squared.
SELF REPORTED CONDITIONS	Dummy variable equal to 1 if respondent reported a non-temporary health condition as stated and zero otherwise.
ARMS	Condition related to arms, legs, hands etc.
CANCER	Condition related to cancer.
CHEST	Condition related to chest or breathing.
DEPRESSION	Condition related to anxiety/depression.
DIABETES	Condition diabetes.
DRUG	Condition related to alcohol or drugs abuse.
EPILEPSY	Condition related to epilepsy.
HEARING	Condition related to hearing.
HEART	Condition related to heart/blood pressure.
MIGRAINE	Condition related to migraine.
OTHER	Condition related to another ailment other than those detailed explicitly.
SIGHT	Condition related to sight.
SKIN	Condition related to skin conditions or allergies.
STOMACH	Condition related to stomach/digestion.
STROKE	Condition related to stroke.
OTHER HEALTH	
ACCIDENT	Dummy variable equal to 1 if the respondent had had an accident in the past 12 months and zero otherwise.
DISABLE	Dummy variable equal to 1 if the respondent was registered disabled and zero otherwise.
HADBABY	Dummy variable equal to 1 if the respondent had had a baby in the past 12 months and zero otherwise.
INCOME	
DECILE	The decile in which the respondent's annual equivalised household income falls.
DECSQ	DECILE squared.
EARN	Natural log of individual monthly earnings.
LMTIME	Natural log of individual number of hours worked per month.
PHYSICAL	
MALE	Dummy variable equal to 1 if the respondent was male and zero otherwise.
AGE	Respondent's age in years divided by 40.
AGESQ	AGE Squared.
AGECUB	AGE Cubed.

SOCIO-ECONOMIC

INACT	Dummy variable equal to 1 if the respondent was economically inactive and zero otherwise.
UNEMPLOY	Dummy variable equal to 1 if the respondent was unemployed and zero otherwise.
CATHOLIC	Dummy variable equal to 1 if the respondent reported being a Catholic and zero otherwise.
COUPDEP	Dummy variable equal to 1 if the respondent reported being part of a couple with dependent children and zero otherwise.
COUPNDEP	Dummy variable equal to 1 if the respondent reported being part of a couple with no dependent children and zero otherwise.
LONEPAR	Dummy variable equal to 1 if the respondent reported being a lone parent and zero otherwise.
SINGLEE	Dummy variable equal to 1 if the respondent reported being over 65 years and living alone and zero otherwise.
SINGLE	Dummy variable equal to 1 if the respondent reported being under 65 years and living alone and zero otherwise.
FAMILY CARER	Dummy variable if the respondent reported being a family carer and zero otherwise.
GRAMMAR	Dummy variable equal to 1 if the respondent reported having attended a grammar school and zero otherwise.
DEGREE	Dummy variable equal to 1 if the highest educational qualification reported by the individual was a primary degree and zero otherwise.
PDEGREE	Dummy variable equal to 1 if the highest educational qualification reported was a nursing or polytechnic degree and zero otherwise.
VOCQUAL	Dummy variable equal to 1 if the highest educational qualification reported by the individual was a vocational qualification and zero otherwise.
ALEVEL	Dummy variable equal to 1 if the highest educational qualification reported by the individual was at A-level or equivalent and zero otherwise.
OLEVEL	Dummy variable equal to 1 if the highest educational qualification reported by the individual was at O-level or equivalent and zero otherwise.
OWNER	Dummy variable equal to 1 if the respondent was an owner-occupier and zero otherwise.
RETIRED	Dummy variable equal to 1 if the respondent was retired and zero otherwise.
A&E	Accident and emergency episodes per head of population in health board.
PATPERGP	Number of patients registered per whole time equivalent GP in health board.
NORTH	Dummy variable equal to 1 if the respondent lived in the Northern Health and Social Services Board area and zero otherwise.

SOUTH	Dummy variable equal to 1 if the respondent lived in the Southern Health and Social Services Board area and zero otherwise.
WEST	Dummy variable equal to 1 if the respondent lived in the Western Health and Social Services Board area and zero otherwise.