"Equity in the Utilization of Hospital In-Patient Services in Ireland: An Improved Approach to the Measurement of Health Need and Differential Cost"

Richard Layte and Miriam Wiley

Working Paper 19

Research Programme on "Health Services, Health Inequalities and Health and Social Gain" *

This programme is supported by the Health Research Board, and is being carried out by researchers at the Economic and Social Research Institute (ESRI), University College Dublin and the University of Ulster.

* Economic and Social Research Institute, 4 Burlington Road, Dublin 4, Ireland. Correspondence to: Richard Layte, Economic and Social Research Institute, 4 Burlington Road, Dublin 4, Ireland. Email:Richard.Layte@esri.ie

Abstract

Hospital services in Ireland have developed into a complex mixture of public and private provision with private patients being treated in public as well as private hospitals. This interweaving of public and private medicine is driven to a large extent by the large proportion of the population covered by health insurance which has grown from 4% in 1960 to over 50% by 2004. This situation has led to concerns that hospital care is not available to all on the basis of need alone but is substantially influenced by personal circumstances. Previous research on Irish hospitals found that utilisation was neutral across the income distribution controlling for health status – i.e., there was essentially equal treatment for equal need irrespective of income. It could be argued however that these analyses did not properly control for health status as those in lower income groups can be shown to have a lower health status within the same response categories within social surveys. Similarly, previous research has also assumed that treatment costs were identical across groups. In this paper we derive a new measure of health – the 'Ill Health Index' using three different health indicators and obtain information on differential costs of treatment across groups. We find that both those with medical insurance and those with medical cards are more likely to use hospital services. The costs of these services are also significantly higher for these groups. Comparison of measures of equity for inpatient utilisation and inpatient costs shows that costs are more pro-poor, but a decomposition of the distribution of hospital costs standardising for health needs shows that higher income groups actually use hospital services more and cost more for the same level of health than lower income groups.

Introduction

Health care services in Ireland are a fascinating and at times, confusing mixture of public and private provision and financing. This is particularly true in the hospital sector where public hospitals and publicly employed consultant doctors cater for both public and private patients. The intermingling of public and private medicine in Irish hospitals has been driven by the steady increase in the numbers of Irish people with medical insurance which has grown from 4% in 1960 to over 50% by 2003 {Health Insurance Authority 2003 2478 /id}, but concerns have been raised that the importance of private care in Irish hospitals means that the health system is not available to all on the basis of need alone, but instead that personal circumstances may well determine the availability and promptness of care. Past research on the Irish system {Tussing 1985 1682 /id}; {Nolan 1991 413 /id}; {Callan & Nolan 1992 672 /id}; {Layte & Nolan 2004 2479 /id}has examined the extent of equity in health service delivery across the income distribution in Ireland - that is, the extent to which there is equal treatment for equal need irrespective of income. This research found that hospital care tends to be more heavily used by those at the bottom of the income distribution, but once we control for levels of health 'need' across income groups the distribution of utilisation is essentially neutral. This research has made a valuable contribution to our understanding, but there are two reasons why results to date may underestimate inequity in health utilisation in Ireland in favour of higher income groups. First, evidence from other countries has suggested that survey evidence on the nature of health 'need', as used in previous Irish research may underestimate the true level of ill health among lower income groups as they tend to be 'sicker' per response category than higher income groups. Adjustments made using single health status variables thus fail to adjust fully for differences in health need. Second, the in patient night measures of utilisation used in previous research may not reflect actual differences in the level of resources used by those at different levels of income. In this paper we seek to improve on past Irish research in two ways. First we improve on the measure of health need by combining a number of different measures of health. Second we improve on previous approaches by complimenting utilisation measures based on hospital inpatient nights with data on the actual costs of treatment for different groups.

Equity in Hospital Care in Ireland

Health spending by the Irish state is the second largest component of the budget (11 billion in 2005) and the acute hospital sector consumes roughly half of the health budget. Public hospitals are classified into two types, Health Board and Voluntary hospitals with the former owned, finance and administered directly by the state through the regional health boards. The latter are owned and operated by the religious orders and lay boards of governors, but are largely financed by state funds. As well as these publicly funded hospitals there are around 20 private hospitals which are run on a not-for-profit basis. The interesting and important feature of the Irish hospital sector is though that private hospital care is provided in public as well as private hospitals by medical consultants who will work in the public and private sectors. Many public hospitals have private or semi-private

accommodation and a private patient will have their accommodation arranged by a consultant who will charge that patient directly for their services as well as working in the same hospital treating public patients for the state. As long as the private patient occupies a bed earmarked as private they, or their medical insurer will pay a daily maintenance charge which covers the cost of all other services outside of the care provided by their consultant. This will include all tests, nursing, junior doctor care, medications and hotel charges. This maintenance charge has been steadily increasing since the mid-1990s and now more accurately reflects the true costs of providing care although there is still a great deal of dispute about this.

The increasing provision of private care in public hospitals has been driven to a large extent by the increasing demand for health insurance with coverage increasing from around 4% in 1960 to over 50% by 2003. State-backed health insurance was introduced to Ireland in the late 1950s in the form of the Voluntary Health Insurance Board (VHI) which was created to provide health coverage for the top 15% of the income distribution who had to pay both maintenance and consultant charges for their care in public hospitals. These patients were known as Category 3 individuals. Category 1 individuals were those with a 'medical card' (around a third of the population) who received free public hospital care. Category 2 individuals received free consultant care, but were liable for a maintenance and out-patient charges. To encourage individuals to take out health insurance they were offered tax relief on their premia and this worked well with around 15% of the population covered by 1970 and more than double that by the late 1980s. In the late 1980s the system of entitlements was rationalised with Category 3 status being abolished and all patients without medical cards now required to pay a relatively small nightly maintenance fee.

By the late 1980s, private practice in public hospitals was well established and {Barrington 1987 2220 /id} has detailed the numerous ways in which private practice was accepted and facilitated. For example, within hospitals, consultants treating private patients had the use of staff and facilities at no extra cost to themselves with, until very recently, their patients charged only the marginal cost[1].

The importance of private care and the extent of fee paying in the Irish system has led many to argue that the system is not available to all on the basis of need alone, but instead that personal circumstances may well determine the availability, quality and speed of treatment. The Commission on Health funding which reported in 1989 {Commission on Health Funding 1989 2480 /id} certainly felt that private status gave more prompt access to hospital services than public status and voiced the opinion of many that consultant physicians gave more attention to their private patients leaving more junior doctors to care for public patients. In this paper we will not be assessing these issues, but instead turn our attention to the issue of whether the level of hospital resources utilised by those with different levels of income are equitable in the light of their health 'needs' or whether higher income and the availability of health insurance increases the resources consumed.

[1] The logic was that private patients had already contributed to the overall cost through their taxation.

Equity in this context is not a simple concept since it can refer both to equity in access to health care and its utilisation. If we believe that equal access to hospital services is most important then we need to examine whether individuals have an equal opportunity to get it, or rather, an equal cost in consuming it. {Mooney 1983 2302 /id}and {Le Grand 1982 2303 /id}have championed this approach, but there is increasing support for an approach to measuring equity which concentrates on whether there is equity in actual levels of consumption. Researchers such as Culyer, van Doorslaer, & Wagstaff (1992) have argued that although the availability and costs of access do matter, we should still nonetheless be primarily concerned with the equity of utilisation across groups. They argue that even where non-use of services by a particular social group can be explained through a lack of information about the availability of services or pure choice, it is important to understand extent of and reasons for the deficit.

In this paper we follow the utilisation approach and seek to find out whether the structure of health services in Ireland leads to higher levels of utilisation among some groups relative to their health needs. Unlike in previous papers we then also extend our analyses to look at equity in the use of resources by measuring the costs of treatment for individuals of different types. This allows us to examine for example, whether those being treated as private patients consume higher levels of resources. It should be remembered in reading the paper that our analyses are of hospital use across the population, but that we use cost data based on averages that cannot differentiate between public and private patients. If private patients routinely consume more resources than public patients for the same treatment, this will not be observed as our data refer to the average cost of particular illnesses in the pubic system. Cost differences are thus a function of number of hospital nights and the illness treated. Similarly, we cannot observe differences in the quality of factors such as the 'hotel' services that private patients consume compared to public patients.

In the next section we examine the data available for this paper before turning in the following section to the distribution and cost of in patient hospital nights. We then turn to the issue of the measurement of health status which as we will argue has been less than satisfactory in past papers. In the final section we move onto the estimation of the degree of equity in hospital services in Ireland.

Data Sources

The Living in Ireland Survey 2000

To examine equity in the utilisation and cost of hospital care in Ireland we require information at the individual level on income, health status and use of hospital services. Fortunately all these data are available for a representative sample of the Irish population in the Living in Ireland Survey (LII). The LII Surveys form the Irish component of the European Community Household Panel (ECHP): an EU-wide project, co-ordinated by Eurostat, to conduct harmonised longitudinal surveys dealing with household income and labour situation in the member states. As well as extremely detailed information on income levels and sources, the LII data also includes information on other

important topics of relevance to this paper including several self-assessed health status measures, health care utilisation and a wide range of socio-demographic characteristics. The first wave of the ECHP was conducted in 1994, and the same individuals and households were followed each year. The wave conducted in 2000, therefore, was the seventh wave of the survey. In 2000, the Irish sample of individuals and households followed from Wave 1 was supplemented by the addition of 1,500 new households to the total, in order to increase the overall sample size which had declined due to attrition since 1994. The objective of the sample design was to obtain a representative sample of private households in Ireland. Those living in institutions such as hospitals, nursing homes, convents, monasteries and prisons, are excluded from the target population, in line with the harmonised guidelines set down by Eurostat and standard practice adopted in surveys of this kind (such as the Household Budget Survey conducted by the Central Statistics Office).

The sampling frame used was the Register of Electors. This provides a listing of all adults age 18 and over who are registered to vote in the Dáil, Local Government or European Parliament elections. This means that the target sample selected using the ESRI's RANSAM procedure was a sample of *persons*, not of *households*. Since the probability of selection is greater for households with a larger number of registered voters, this means that the resulting sample will tend to over-represent larger households. This was taken into account in reweighting the sample for analysis.

The total number of households successfully interviewed in 1994 was 4,048, representing 57 per cent of the valid sample. The number of households and individuals being interviewed declined with attrition over time so in 2000 the original sample was supplemented with an additional 1500 households selected using the same procedure.

The sample supplementation exercise, together with the follow-up of continuing households, resulted in a completed sample in 2000 of 11,450 individuals in 3,467 households. Individual interviews were conducted with 8,056 respondents, representing 93 per cent of those eligible (born in 1983 or earlier). This sample was reweighted to take account of sampling error from the actual population in 2000 and these weights are used throughout this paper, thus the data is fully representative of the Irish population in private households in that year.

The Hospital In Patient Enquiry Database (HIPE)

One of the innovations of this paper is to move from measuring the utilisation of hospital services in terms of individual bed nights to measuring costs per night and how these vary between types of individuals. To make this transition we need information on the relative costs of treatment that can be matched to individuals in the LII Survey. The Hospital Inpatient Inquiry scheme (HIPE) provides just such data. HIPE is a computer-based health information system designed to collect clinical and administrative data on discharges and deaths from acute hospitals in Ireland. HIP was established in 1971 and is the

principal source of national data on discharges from acute general hospitals. The HIPE scheme accepted data from 60 hospitals in the year 2000, 2 of these private hospitals. HIPE collects information on thirteen elements of inpatient care, five of which were derived for this paper: age, sex, public/private status, Medical Card status and Diagnosis Related Group (DRG). The DRG specifies the illness for which the person[2] is being treated, but also provides the key to the resources being consumed.

Each year the Department of Health and Children calculates the average cost of each DRG group for that year taking into account the total resources consumed (net of capital costs). DRG costs are presented as 'Relative Values' (RV) which are an expression of the resource use of this DRG relative to the average use across all participating hospitals. In 2000 this average was €2454 per day, but it is important to remember that this is the average across both public and private patients. Information systems do not permit the breakdown of costs by patient type at present and so our estimate of costs is actually only a function of hospital nights (derived from the LII Survey) and the cost of the DRG.

The distribution and Cost of In Patient Hospital nights

In this section of the paper we examine the distribution of utilisation of hospital inpatient services and the manner in which the cost of this utilisation varies across the population. As just described, the LII survey in 2000 included a question on the number of nights that the individual spent in hospital in the last year and whether, for women, this was due to the birth of a child. Unfortunately respondents were not asked the number of nights that they spent in hospital as a result of childbirth, but analysis showed that having a child tended to increase usage by three nights on average and so three nights were deducted for each respondent having a child. Table 1 shows some basic statistics on the distribution of hospital nights by sex and age group and shows that, on average women are more likely to experience a night in hospital and only in the group aged 61-70 are men more likely then women to experience a night in hospital. Both men and women are more likely to use inpatient services as they get older, but whereas for women this process seems linear, for men aged over 80, the proportion requiring hospital in patient nights decreases.

Table 2 shows a different pattern of usage however for those experiencing one or more nights in hospital in the last year with men having a higher median number of nights in hospital in all age groups except the 31-40s and 71-80s. Therefore, although men are less likely than women to be an inpatient on average, when they are it tends to be for longer.

[2] Our data are however 'discharges' of which a single person could have several if they had more than one spell in a hospital or transferred between hospitals.

Table 1: Distribution of Nights as an Inpatient by Sex and Age Group

	<21		21-30		31-40		41-50		51-60		61-70		71-80		80+		All	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
Zero	95.4	93.8	93.3	90.8	93.0	80.9	91.8	88.7	89.6	88.4	80.2	85.9	78.4	76.3	84.3	73.8	90.3	86.3
1-5	2.4	4.9	4.3	7.7	4.9	15.2	4.2	6.1	5.0	6.9	7.7	4.7	9.4	6.9	5.6	15.6	5.0	8.4
6-10	1.2	0.6	1.9	0.6	0.5	1.3	1.6	3.2	2.1	1.5	4.0	4.7	6.5	3.7	5.6	4.1	2.1	2.0
11-20	0.6	0.6	0.1	0.5	0.1	1.0	2.0	1.2	2.3	0.5	5.0	3.0	2.0	12.0	3.4	0.0	1.5	1.9
21-50	0.3	0	0.3	0.3	1.3	0.6	0.4	0.6	0.7	1.6	2.9	1.0	2.4	0.9	1.1	5.7	1.0	0.9
51-365	0	.0	0.1	0.1	0.0	0.9	0.0	0.3	0.2	1.1	0.3	0.7	1.2	0.3	0.0	0.8	0.2	0.5
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 2: Distribution of Nights as an Inpatient by Sex and Age Group For Those with 1+ Inpatient Nights

	<21		21-30		31-40		41-50		51-60		61-70		71-80		80+		All	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
Median	5.98	2.00	4.00	2.00	1.60	3.00	5.17	5.00	7.00	4.00	7.00	7.00	7.00	14.00	7.67	5.00	5.00	4.00
Mean	9.41	4.01	12.60	5.12	8.58	7.02	8.38	9.11	8.76	13.12	13.78	13.23	13.16	11.40	18.27	13.60	11.24	9.27
Std	13.86	6.80	40.69	11.04	12.67	14.71	7.72	14.62	11.35	20.28	20.24	18.48	20.25	12.27	56.30	19.28	23.81	15.40

As outlined in the last section, the HIPE data base can provide estimates of the average cost of a different conditions for which people are treated in acute hospitals and this provides us with an opportunity to enhance our understanding of equity in the utilisation of hospital services since some groups may be more resource intensive than other groups as a function of the conditions for which they are admitted to hospital and/or the procedures which they undergo.

For example, patients who undergo surgery would tend to consume more resources than patients who receive some form of drug treatment alone, although some treatments may require expensive medications. As discussed in the last section, each year the Irish department of Health and Children produces a measure of the relative cost (known as RVs) or Relative Values) of each 'diagnosis related group' or DRG and which summarizes the costs incurred on average treating each condition including variance in the number of nights in hospital required. Ideally we would like to have information on the condition that brought each individual in the LII survey into hospital (i.e. the DRG) to which we could apply the appropriate RV, but as a general social survey, the LII does not contain this data. We do have RVs for the conditions in the discharge data from the HIPE Register and this gives us another method through which we can apply RV information to the LII survey data. Both HIPE and the LII contain common variables that can be used to identify groups which may vary significantly in the resources used in their treatment - primarily age and sex. From the perspective of this paper though, we would ideally like both data sets to contain information on income so that we would be able to address the issue of equity across the income distribution. HIPE does not contain income data, but it does contain variables measuring whether the person has, or is covered by a medical card and whether the person has medical insurance. These are good indicators of an individuals level of resources as can be seen from Table 3 which gives the proportion in the LII Survey with a medical card/insurance by income quintile.

Table 3: Proportion with a Medical Card/Private Health Insurance By Equivalised Disposable Household Income Quintile

	Medical Card	Insurance
Lowest	52.4	5.2
2nd	24.9	14.5
3rd	10.1	22.2
4th	7.7	28.2
Highest	4.9	29.8
	100	100

Possession of a medical card is a very good indicator of level of household resources with around 52% of those in the lowest quintile having a card compared to 5% in the highest and a steady gradient across the groups. The gradient is also plain for insurance although not as stark. Combining age, sex, medical card status and possession of insurance we will be able to construct groups for which an average RV measure can be calculated and applied to each night reported as an in patient by the individual. The cross-tabulation of age group (19 categories), sex, medical card status and insurance produces 152 categories in the HIPE database for 2000 for which an average RV is

calculated for each[3]. These averages are then matched to the same cross-tabulated groups in the LII Survey. In the next section we examine the factors that determine the costs of hospital in patient services as measured by the RV data from HIPE. We return to the issue of the issue of the equity of utilisation costs in the final section.

Modelling Hospital Utilisation Costs

Table 1 showed that 90% of men and 86% of women in the LII Survey had not had a night in hospital in the last year and this presents difficulties for estimation of the determinants of utilisation. The issues around modelling such limited dependent or 'truncated' variables have received considerable attention in the health economics literature. This has debated the relative merits of two-part models and one step, generalised tobit or sample selection models. The general problem is that a large number of zero observations in data is consistent with at least two scenarios, each of which requires a different analytical approach {Maddala 1985 2481 /id}; {Jones A.M 2000 2482 /id}.

Table 4: Logit Model of Probability of A Hospital Night

Variables	Model 1			Model 2			Model 3		
	β	S.E	Sig.	β	S.E	Sig.	β	S.E	Sig.
Male Aged 21-30	0.45	0.41	n.s	0.35	0.41	n.s	0.26	0.41	n.s
Male Aged 31-40	0.36	0.44	n.s	0.06	0.44	n.s	-0.04	0.43	n.s
Male Aged 41-50	0.61	0.40	n.s	0.29	0.40	n.s	0.17	0.40	n.s
Male Aged 51-60	0.79	0.39	*	0.26	0.40	n.s	-0.01	0.40	n.s
Male Aged 61-70	1.47	0.39	***	0.74	0.39	n.s	0.49	0.39	n.s
Male Aged 71-80	1.44	0.39	***	0.75	0.40	n.s	0.52	0.40	n.s
Male Aged 80+	0.89	0.48	n.s	0.19	0.49	n.s	-0.10	0.50	n.s
Female Aged <21	-0.10	0.48	n.s	0.06	0.48	n.s	-0.16	0.49	n.s
Female Aged 21-30	0.23	0.38	n.s	0.15	0.38	n.s	-0.20	0.38	n.s
Female Aged 31-40	0.99	0.37	**	0.82	0.38	*	0.54	0.38	n.s
Female Aged 41-50	0.83	0.37	*	0.46	0.39	n.s	0.13	0.39	n.s
Female Aged 51-60	0.90	0.38	*	0.41	0.38	n.s	0.09	0.38	n.s
Female Aged 61-70	0.98	0.38	*	0.52	0.39	n.s	0.22	0.40	n.s
Female Aged 71-80	1.52	0.41	***	0.76	0.41	n.s	0.55	0.42	n.s
Female Aged 80+	1.61	0.48	**	0.80	0.52	n.s	0.34	0.53	n.s
Rural Area	0.02	0.11	n.s	0.03	0.11	n.s	0.01	0.12	n.s
Gave Birth in Last Year	2.30	0.31	***	2.47	0.35	***	2.18	0.28	***
Insured	0.29	0.15	*	0.39	0.15	*	0.28	0.16	n.s
Have Medical Card	0.72	0.16	***	0.30	0.16	n.s	0.13	0.18	n.s
Good SAH				0.69	0.15	***	0.59	0.15	***
Fair SAH				1.71	0.17	***	1.26	0.19	***
Bad or V.Bad SAH				2.66	0.23	***	1.95	0.27	***
GP Visits							1.07	0.12	***
Equivalised Income							0.00	0.00	n.s
Constant	-3.34	0.36	***	-3.69	0.36	***	-5.47	0.42	***
N	8037			8037			8037		
∆LL over Zero Slopes	-2612.96			-2434.04			-2327.77		
Wald Chi^2	169.08			322.89			537.477		

[3] For the year 2000, the average costs across all DRGs was €2454 per night in a public hospital.

First of all, they could represent plain infrequency of usage or recording error in which case a one step approach which takes account of the truncated (i.e. non-negative) nature of the data would be appropriate. This would assume that the process determining the zeros in the data was identical to that determining the level of costs, i.e. those with zero values could potentially have hospital costs. If, on the other hand, the zeros represent the outcome of a two-step procedure, say the decision of the person to first seek care, followed by a further decision on type and duration of treatment, it may be that the assumption of identical processes is invalid and a two-step estimation procedure would be more appropriate. In terms of modelling hospital utilisation in the Irish context arguments could be made for both approaches. If hospital stays are regarded as an infrequent occurrence over which the individual has very little control, because perhaps all admissions are through medical emergency, then a one step estimation procedure is appropriate. Not all admissions are emergencies however and a substantial proportion may in fact be admissions for elective procedures for which the individual will have usually had to have made the decision to visit their GP.

Given these uncertainties, we adopt a modelling strategy which is something of a compromise. As in a two part-stage modelling procedure we will estimate a set of logit models of the probability of having a night in hospital in the last year. This will allow us to examine whether access to hospital services is shaped by factors such as medical card receipt or insurance and the role of GPs as 'gate keepers'. We then go on to estimate the cost of these nights in hospital, but do so using the standard tobit model {Jones A.M & Posnett 1991 2483 /id} which assumes no selection process but controls for the truncated nature of the dependent variable[4]. We begin with three logit models of the probability of having an inpatient night in the previous year; the results for these models are shown in Table 4. The first model estimates the effects of age, sex (combined), living in a rural area, having had a child in the last year, whether the person is medically insured and whether they are the holder of, or are covered by a medical card. We are interested in the impact of medical insurance and having a medical card, but in the first model estimate the impact of these variables without controlling for health status or GP visitation. Previous research has shown that those having either medical insurance or a medical card have higher rates of hospital inpatient nights (Nolan 1991:123), but it may be that the higher rate among medical card holders simply reflects lower health on the part of medical card holders. The economic incentive to holders of insurance may create the increased demand on their part, but one would imagine that this demand must operate through access to GPs and specialists in a non-inpatient context.

To test these hypotheses, in the second model we add variables for health status to examine whether this moderates the impact of the medical card. In the third model we add number of GP visits and income to examine the role of GPs as gatekeepers of hospital services, and in particular, if they sanction higher rates of utilisation for insured persons. It may be however that higher rates of GP utilisation are a consequence of a period in hospital rather

[4] Although it could be suggested that the negative binomial or zero inflated negative binomial would be a better choice for the second stage model, our data are not pure count data and so the tobit specification is the more appropriate.

than their antecedent, but if so the affect should be generalised and not specific to the insured.

Model 1 in Table 4 shows that the age/sex affects are fairly significant with increasing positive affects as age increases, particularly for women. Having had a child in the last year also proves to be a significant and positive influence increasing the odds tenfold. Both the variables for having insurance or a medical card are significant with the medical card affect being substantially larger.

If we then control for health status in Model 2 we find that having a worse self assessed health is associated with an increasing probability of a hospital night with a clear gradient as we move from very good to bad health. Interestingly, controlling for health status moderates the impact of the medical card term and renders it insignificant, but actually increases the affect of the insurance term. This suggests that the positive impact of having a medical card is largely due to lower health among recipients rather than any form of 'moral hazard' due to greater access. Adding number of GP visits in Model 3 shows that this is an important variable with a strong positive affect in its own right and plus making the term for medical insurance insignificant and weaker. This suggests that the positive impact of insurance works through GPs, perhaps via referrals into the hospital sector.

Table 5: Tobit Model of Hospital Costs

Variables	Model 1			Model 2		
	β	S.E	Sig.	β	S.E	Sig.
Male Aged 21-30	49109.20	12284.37	***	42522.06	11837.53	***
Male Aged 31-40	46365.85	12388.94	***	32721.46	12005.27	**
Male Aged 41-50	40453.66	12356.49	**	23397.21	11996.01	n.s
Male Aged 51-60	51750.58	12472.63	***	27313.20	12085.32	*
Male Aged 61-70	77760.74	12400.08	***	40689.53	12051.70	**
Male Aged 71-80	74306.58	13013.90	***	41293.06	12631.56	**
Male Aged 80+	64109.91	16449.08	***	34116.30	15896.87	*
Female Aged <21	-4078.27	15038.96	n.s	4864.59	14278.19	n.s
Female Aged 21-30	32849.57	12425.36	**	30866.00	11955.81	*
Female Aged 31-40	65770.96	11913.33	***	57392.71	11496.03	***
Female Aged 41-50	50978.17	12129.01	***	36862.54	11697.24	**
Female Aged 51-60	50145.14	12324.03	***	27629.75	11941.47	*
Female Aged 61-70	59042.13	12609.45	***	36428.64	12232.24	**
Female Aged 71-80	81615.93	12537.50	***	45321.75	12180.20	***
Female Aged 80+	86522.23	14374.87	***	52896.77	13701.00	***
Rural Area	-22876.04	3220.25	***	-20246.06	3070.94	***
Insured	9307.38	3908.54	*	10964.33	3788.88	**
Have Medical Card	37491.58	4311.56	***	15167.41	4260.25	***
Gave Birth in Last Year	83575.72	5740.50	***	84238.63	5420.16	***
Good SAH				32455.00	4001.50	***
Fair SAH				79107.80	4781.66	***
Bad or V.Bad SAH				119843.10	6725.28	***
Equivalised Income				7.58	5.00	n.s
Constant	-156201.60	11954.53	***	-168308.40	12078.05	***
N	8037			8037		
∆LL over Zero Slopes	-14084.5			-13843.8		
Chi^2	610.29			1091.69		

Having modelling the probability of a hospital night we can now turn to models of the costs of utilisation as derived from the LII and HIPE data sets.

We follow a very similar strategy to that used in the last section and enter variables for age/sex, rural location, medical card, insurance and whether given birth in the last year in the first instance. Having established these affects we then enter variables for self-assessed health status and equivalent income.

Table 5 Model 1 shows that we see very pronounced age/sex affects with older respondents associated with increased costs and particularly women over 70. In contrast to the logit model, here being from a rural area has a negative impact controlling for age and sex which may suggest that transport costs may be associated with lower utilisation for rural people, but if so this affect should have been apparent in the logit models. Model 1 shows that giving birth in the last year, having a medical card and insurance all have significant positive affects on utilisation costs. Adding health status in model 2 has an important affect on the variables for insurance and medical card status. Whereas controlling for health status marginally increases the costs for insurance holders, suggesting that those with very good health (the reference category) and insurance tend to have more expensive procedures), the affect for medical card holders is halved. This suggests, as with the logit models that much of the higher utilisation by medical card holders is due to a worse health status on their part. Examination of similar estimates based on nights in hospital rather than nights*cost show that the same pattern emerges except that the coefficient for having insurance is a greater proportion of that for having a medical card suggesting that costs for those with insurance are higher.

The results from these two sets of models have some very interesting implications. On the one hand it is reasonably clear that the higher probability of having any night in hospital among medical card holders is largely due to their relatively poor health status, even when controlling for age. However, medical card holders are likely to spend more nights in hospital (again controlling for age) with resultant higher costs. Those with medical insurance are also more likely to spend a night in hospital, but this affect was not moderated by health status suggesting an incentive on the part of the insurance to utilise hospital services, possibly for elective procedures, which is not in proportion to their overall health status relative to non-insured persons. Those with insurance are also likely to spend more nights in hospital and cost more controlling for age, sex and health status. Our analyses earlier showed that medical cards and insurance are distributed very differently across the population and so it is not clear the manner in which the higher usage by card holders and the insured will impact on overall levels of equity in hospital services. This is the issue we turn to in the next sections, but before we do so we first need to deal with the issue of the measurement of health status.

Standardising for Health Need to Measure Equity

The measurement of horizontal equity in the utilisation of hospital services requires that we control not only for factors such as age and sex, but also the distribution of health status. Equity here is defined as equal treatment for equal health need and this requires that we have adequate measures of health need. In Layte and Nolan (2004) three different health status measures

were used to standardise for the level of health need – a *medical* measure based on whether the respondent had a chronic illness, a *functional* measure based on whether the respondent had 'cut down due to mental or physical illness or injury' and a *subjective* measure based on the question "in general, how good would you say your health is?". These measures were all inversely related to income in the sense that those lower down the income distribution were more likely to have a chronic illness, a limiting health condition or assess their health as bad. However, the three measures varied in the extent to which they were concentrated on poorer individuals, as can be seen from Figure 1 which utilises 'concentration curves' {Wagstaff, Paci, et al. 1991 2221 /id} to illustrate the point. Concentration curves cumulatively rank individuals (or groups) by their income against their proportion of illness. If illness is equally distributed across the population then the curve will coincide exactly with the diagonal, or 'line of equality'. If, on the other hand, illness is concentrated in lower income groups the line will lie above the diagonal, and vice-versa.

FIGURE 1 ABOUT HERE

Figure 1 confirms that all three measures are concentrated among lower income groups, but also that chronic illness is the most unequally concentrated with level of self-assessed health the least concentrated. These differences in distribution across income mean that the measures will differentially standardise for health need and thus yield different estimates of the extent of equity in hospital utilisation, but there may also be more worrying problems.

Table 6: Distribution of Self-Assessed Health by Chronic Illness and Disposable Household Income Quintile

	Self Assessed Health	No Chronic	Chronic
Lowest	Good	85.8	27.4
	Fair	13.4	55.7
	Bad	0.8	16.9
	Total	100	100
2nd	Good	94.6	41.9
	Fair	5.4	42.4
	Bad	0.0	15.7
	Total	100	100
3rd	Good	96.0	43.5
	Fair	3.8	45.4
	Bad	0.2	11.1
	Total	100	100.0
4th	Good	95.0	43.4
	Fair	4.9	42.9
	Bad	0.1	13.7
	Total	100	100.0
Highest	Good	93.8	48.2
	Fair	6.2	42.0
	Bad	0.0	9.8
	Total	100	100

The standard assumption when using these measures is that, within categories, they reflect the same health status across different groups, e.g those with 'bad' health in the lowest income category are no sicker than those

with ‘bad’ health in the highest income category. but this assumption may not be warranted. In the absence of some ‘gold standard’ against which subjective assessments can be judged (such as clinical appraisal of an individuals health status), it is difficult to fully validate responses to social survey questions, but Table 1 shows that answers across groups may not be comparable.

Using a three category variable representing self-assessed health we can see in Table 6 that for both those with and without a chronic illness, those in the lowest income quintile have a lower self-assessed health than other categories, but that the differential is particularly large for the later where the highest income category are 76% more likely to have ‘good’ health than the lowest income category and 11% more likely than the other income categories. Similarly, the lowest income categories are more likely to ‘bad’ health with a chronic illness with bad health displaying a pronounced gradient across the income groups.

These results suggest that for the measure of chronic illness at least, those in lower income groups seem to be ‘sicker’ in what is ostensibly the same category. If so, this would suggest that a measure of chronic illness should not be used for standardisation purposes, yet as Figure 1 showed, the chronic illness measure is the most ‘pro-poor’ health measure. Using a range of measures may improve the situation, but it is likely that each of our observed health variables is in fact a flawed measure of an underlying, latent dimension of ill health. Given this, the more appropriate response may be instead to try to combine the different measures of health status into a single indicator which summarises health on a single dimension and distils from the three indicators their common component. {Adda, Chandola, et al. 2003 2484 /id}has suggested a method through which different health indicators can be combined based upon principal components analysis (PCA) and this is the procedure we adopt here. Using PCA we seek to establish the hypothetical factors which are common to our three health variables, that is:

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + a_{j3}F_3 + d_jU_j$$

Where z_j is variable j in standardised form, F_i are the hypothetical factors, a_{ji} the standardised regression coefficients of variable j on factor i and U_j the unique factor for variable j (d_j is the regression coefficient for this unique factor). After deriving a_{ji} examination of the common factors showed a single dimension that we could label ‘ill health’. We then weight each of the variables by a_jF[ill health] to create a single ‘Ill Health Index’. Table 2 gives the mean and standard deviations for this index cross-tabulated for different income quintiles and presence of chronic illness. Not surprisingly, those with a chronic illness have a higher score, whereas for those with no chronic illness the differentiation is between the lowest quintile and all others, for those with a chronic illness there is a much more defined gradient as Table 7 now includes information from the self-assessed and limiting illness measures.

Table 7: Ill Health Index[5] By Income Quintile and Chronic Illness				
	No Chronic		Chronic	
	Mean	Std	Mean	Std
Lowest	9.29	0.7	14.06	1.31
2nd	9.07	0.48	13.47	1.68
3rd	9.04	0.42	13.22	1.71
4th	9.04	0.47	13.24	1.73
Highest	9.06	0.51	12.86	1.81

As a more refined measure of health status, the IHI should perform better than single or multiple items when standardising for health need in the measurement of equity in utilisation. This is the aim of the next section.

Measuring Equity in The Utilisation and Cost of Hospital Services

We have now constructed the two methodological tools that we require to better measure equity in hospital utilisation: a measure of the cost of hospital services utilised and a more appropriate health measure with which to standardise for health need. In this section we now apply these measures and decompose the results to get a better measure of the degree of equity.

We start the analyses by examining the distribution of utilisation and cost across the income distribution. Table 8 shows that there is a rough gradient in inpatient utilisation with those in the lowest income quintile are more likely to have had a night in hospital.

Table 8: Distribution of Nights as an Inpatient by Equivalised Disposable Income Quintile					
	Lowest	2nd	3rd	4th	Highest
Zero	83.9	87.5	87.5	90.2	90.2
1-5	8.0	5.7	7.0	6.6	6.1
6-10	2.9	3.2	3.2	1.5	1.9
11-20	3.1	2.2	1.7	.9	0.6
21-50	1.7	0.9	0.2	0.7	0.8
51-365	0.4	0.4	0.3	0.1	0.5
	100	100	100	100	100

Table 9: Shares of Hospital Nights and Costs by Equivalised Disposable Income Quintile		
Quintile	Nights	Costs
Lowest	30.4	26.3
2nd	22.4	32.0
3rd	18.8	18.6
4th	11.9	4.7
Highest	16.5	18.4
CI	-.124	-.154
S.E	0.054	0.057
P	0.021	0.006

[5] For ease of interpretation, the Index of Ill Health is rescaled to have mean 10 and standard deviation of 2.

This gradient in usage of services is also reflected in the shares of both hospital nights and costs by quintile (Table 9) with the lowest quintile utilising over 30% of hospital nights and the second quintile 22%. At first glance the distribution of hospital treatment costs are not as pro-poor as hospital nights with the lowest quintile consuming 26% of costs compared to 32% for the second quintile, but the concentration index (CI) at the bottom of Table 9 tells a different story. The concentration index (Wagstaff et al 1991) is an extension of the concentration curve methodology used to examine the distribution of health and is calculated as minus twice the area between the concentration curve and the diagonal. Scores range from –1 (all utilisation amongst the most disadvantaged) to +1 (all utilisation amongst the most advantaged). The CI for hospital costs is lower than that for hospital nights suggesting a more pro-poor distribution. This may partially be because of the very low proportion taken by those in the fourth quintile who consume less than 5% of costs.

It is clear then that hospital utilisation and costs tends to be distributed in a pro-poor manner, but to what extent is this a consequence of a greater need for hospital care among lower income groups because of a worse health status? To examine this question we will seek to standardise for health status using the Ill Health Index, but we will also need to control for other factors that may confound the relationship such as age and sex. We have seen that higher utilisation is strongly associated with age and older persons also tend to have lower incomes and thus we will need to control for this when assessing equity across the income groups.

Here we want to estimate the partial correlation of the confounding variables sex and age on total hospital usage/hospital costs conditional on health status. After the concentration index of utilisation has been standardised, the Health Inequality (HI) index is computed as the unstandardised CI minus the standardised CI. If after this procedure HI is negative we will have evidence that the distribution of health usage/costs is actually skewed toward the worse off. If, on the other hand the HI index is positive, usage/costs are skewed toward the better off. Given our previous methodological discussions one would expect that the estimation procedure that we use should take account of the fact that the dependent variable is inherently non-linear because of the preponderance of zeros in the population. It would be possible to use various specifications of two-part models to overcome this problem, but their intrinsic non-linearity makes (linear) decomposition impossible. However, {van Doorslaer & Koolman 2000 1830 /id} have shown that the measurement of horizontal inequity hardly differs between OLS-based two-part models and non-linear two-part model specifications such as the logistic model combined with a truncated negative binomial model. To estimate the concentration index we thus rely on linear decomposition methods based on an indirect method of standardisation using OLS regression as shown in equation 1:

1.

$$y_i = \alpha + \beta \ln inc_i + \sum_k \gamma_k \chi_{k,i} + \varepsilon_i$$

where use of health care (y_i) is predicted by log of household equivalised income (ln*inc*) of individual *i* and a set of *k* need and confounding variables (χ_k). α, β and γ are parameters and ε_i is an error term.

Equation 1. can be used to generate need-predicted values of y, i.e. the expected use of medical care by individual I on the basis of their need characteristics, It indicates the amount of medical care they would have received if they had been treated as others with the same need characteristics on average. Combining OLS estimates of the coefficients in equation 1. with actual values of the χ_k variables and sample mean values of lninc_i, we can obtain the need-predicted, or 'x-expected' values of utilisation, $\hat{y}_i^x$ as:

2.

$$\hat{y}_i^x = \hat{\alpha} + \hat{\beta} \ln inc^m + \sum_k \hat{\gamma}_k \chi_{k,i}$$

Estimates of the indirectly need-standardised utilisation, $\hat{y}_i^{IS}$ are then obtained as the difference between actual and x-expected utilisation, plus the sample mean (y_m):

3.

$$\hat{y}_i^{IS} = yi - \hat{y}_i^x + y^m$$

Table 10 gives the resulting figures from this standardisation for the measure of hospital nights and nights*costs.

Table 10: Standardised Concentration and Health Inequality Indices for Total Healthcare Utilisation

	Hospital Nights	Costs
CI	-0.124	-0.154
(Standard Error)	(0.054)*	(0.057)**
HI	0.11	0.111
(Standard Error)	(0.051)*	(0.054)*

*=P<0.05; **=P<0.001

Table 10 shows that once we standardise for age, sex and level of health need (measured using the Ill Health Index) the health inequality index (HI) is significantly positive, suggesting that the better off use healthcare substantially more for a given level of health need. This is in contrast to the results found by Layte and Nolan (2004) who found, after standardising for chronic illness and self-assessed health that the distribution of hospital care was essentially neutral. The results in Table 10 show the importance of appropriate measures of health when examining issues around equity.

Summary and Conclusions

The Irish hospital sector is a complex and often confusing mixture of public and private provision which has developed since the late 1950s. The present system is still deeply influenced by the decision in the late 1950s to establish the tripartite system of entitlements where only one third of the population received free care, married to a policy of subsidised health insurance. This system strongly incentivised the purchase of health insurance for those

outside of the free care group that could afford it as it meant relief from possibly expensive medical bills and prompt access to medical services. Since the early 1960s the proportion insured has gradually increased and in 2004 roughly half the population now have insurance. This brings up a number of issues including equality in speed of access to hospital services and the quality received, but here we have sought to answer a different question: does the extent of paying in the Irish system lead to inequities in the overall utilisation and cost of services across the income distribution? That is, do those with higher incomes receive a greater proportion of hospital care net of their health need? Previous attempts at answering this question have suggested they are not, but there are concerns that this research has not adequately measured differentials in the level of health need across the population which leads to biased estimates of the degree of equity across the income distribution. It may also be that measures of utilisation based on nights in hospital may also under-estimate the actual costs of providing this care for different groups.

In this paper we set out to rectify these methodological difficulties by sourcing and applying a measure of the costs of utilisation and developing an improved measure of health needs. Our analyses of the utilisation and costs of hospital services showed that the elderly tend to have a higher tendency to use hospital inpatient services and that the services utilised also tend to be more expensive as a result of the types of illnesses and procedures that older people undergo. Analyses of the probability of having a night in hospital showed that having a medical card or medical insurance had a significant positive impact, but that the medical card affect was explained by the greater health needs of those with medical cards. Analysis of the costs of utilisation again showed that medical card holders and the insured also tended to have higher costs of treatment. As these variables were very differently distributed across the income distribution this had equivocal implications for equity.

The final section of the paper decomposed the degree of equity across the income distribution standardising for health status using the composite ‘ill health index’ and showed that although unstandardised hospital utilisation and costs are very pro-poor, once standardised they reveal a significantly pro-rich distribution.

These results contradict previous results but we feel that they are based upon a more secure methodological base. Analyses which are not contained within this paper show that insured spells in hospital tend to be more expensive because of the procedures undertaken, that is, there tends to be a higher level of surgical procedures for insured patients, quite often undertaken on an elective basis. Given that there is good evidence that private patients have quicker access to hospital services and some evidence that treatment is more likely to be by a consultant rather than a junior doctor, the finding that private patients tend to cost more is worrying. The analyses presented here are if anything a conservative estimate of costs for private patients as our figures are based on average costs per DRG across public and private patients. It may be then that private patients actually cost substantially more per DRG than is revealed here. Unfortunately, information services within the Irish system cannot at the moment differentiate resource use by different categories of patient.