**Measurement of Inequity in the Delivery
of Public Health Care:
Evidence from Spain (1997)
by
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Abstract

This paper assesses horizontal equity in the delivery of public health care in Spain, and tries to identify those health care levels and population groups where inequality is concentrated. Different kinds of health care are analysed for 1997, both at disaggregate and aggregate level. The results show that the socio-economic population groups affected by inequity vary according to the specific health care level studied although, in global terms, there is not a clearly significant degree of inequity. The Spanish results are also compared to those obtained for other European countries.

Keywords: Horizontal equity; Health expenditure; Medical care delivery; Count data

JEL classification: D63; H51

1. Introduction

The achievement of equity is one of the basic aims of the public sector and closely linked to its role as revenue collector and service provider. In fact, the question of distribution ranks high amongst social preferences in modern societies. Consequently, evaluation of public sector activity must consider, among other factors, those achievements made in the field of equity. This paper firstly concentrates on the measurement of horizontal inequity in the delivery of public health care in Spain, an important issue since expenditure on public health care represents over 5 per cent of Spanish GDP. Secondly, the results are compared to those of other European countries, in order to remark the peculiarities of the Spanish health care system.

Medical care in Spain is mainly provided by the National Health Service (NHS), and it is financed from general taxation. The radical change from the previous Social Security system, basically financed by workers' and employers' contributions, to the present NHS, was shaped by the 1986 General Health Act. Today, the NHS comprises seven Regional Health Services, which manage public health care in those regions having responsibility for health services, and INSALUD, the agency that manages public health care in the rest of the country. This process of decentralization, which will be further developed in the near future, has produced some differences in health care delivery between regions. The Spanish NHS covers virtually the entire population and provides health care free of charge, except for medicines, for which the patient pays 40 per cent of the cost.¹ It provides wide-ranging benefits, although dental care (except for extractions) and mental health care are not publicly financed. Freedom of choice is limited, especially with regard to preferences for particular specialists. Except in the case of emergencies, General Practitioners (GPs) are always the first point of contact with the health care system; they act as gatekeepers for specialists and can also refer the patient directly to hospital. Thus, the role of doctors is especially important in determining specialised health care consumption.

To date, there has been little research on equity in the delivery of health care in Spain.² Rodríguez et al. (1993) examine this issue for the health care system as a whole, while Abásolo (1998) focuses on public health care delivery in one Spanish region (the Canary Islands), although he also calculates the extent of inequity for the whole country. Both studies measure horizontal inequity over a one-year period and do not consider separately different levels of health care

¹ Excluding pensioners, for whom medicines are free of charge, and patients with certain chronic conditions, who have to pay 10 per cent of the cost.

² There are many Spanish studies devoted to other aspects of equity in health care. A review of the main Spanish literature on this subject is included in González and Urbanos (2000).

services. Urbanos (2000) applies a recent methodology for measuring horizontal inequity in the delivery of public medical care for three years (1987, 1993 and 1995), and she identifies those health care services in which inequality is most evident.³ This paper updates the results from that previous work.

Following this introduction come four further sections. Section 2 briefly summarises the method used in the measurement of inequity. Section 3 describes the data and estimation strategies, while section 4 analyses the main results. Finally, section 5 discusses the results and compares them to those from other European countries.

2. Method

Most modern societies approach the issue of distribution from the starting point that equality is desirable. As a result, horizontal equity in medical care delivery can be defined in several ways [Mooney (1983)]. Nevertheless, the debate about the adequacy of different equity criteria has been focused on two main concepts: ‘equal access to equal need’ and ‘equal use to equal need’, where need is usually proxied by health status.⁴

Health legislation in Spain, as in many other countries, defines equity goals in terms of access. However, it is broadly accepted that policy makers refer to actual consumption and not to possibilities to consume when defining equity-related aims. Therefore, most empirical studies that focus on measurement of inequity try to test if individuals having equal need receive the same amount of medical care irrespective of their income. In recent years, considerable efforts have been made to construct an appropriate index for measuring inequity [e.g. Wagstaff et al. (1989), (1991), Wagstaff and van Doorslaer, (2000)]. The most recent index, the so-called HI_{WV} , proposed by Wagstaff and van Doorslaer (2000), overcomes the limitations of former proposals. This index is based on the computation of concentration curves and establishes inequity as the difference between the need for medical care and real health care consumption, where need is calculated by the method of indirect standardization.

³ Other Spanish works have employed regional surveys with the same purpose. For example, Gallo et al. (1999) use the Catalan survey. Their results show that equity levels in Catalonia are similar to those of other European countries. Esnaola et al. (2001) examine equity in the delivery of public health care in the Basque Country for 1997. Their results reveal the presence of pro-poor inequity in primary and inpatient care, as well as some pro-rich inequity related to specialised outpatient care. Finally, results for aggregate utilisation suggest that inequity is not significant.

⁴ See Mooney et al. (1991), (1992) and Culyer et al. (1992a), (1992b) as an example of this debate.

Let m_i denote the amount of medical care received by an individual i . According to Wagstaff and van Doorslaer, the need for medical care for the i 'th individual can be expressed as:

$$m_i^* = \beta' \cdot x_i \quad (1)$$

where x is a vector including demographic and morbidity variables, and m_i^* indicates how much medical care each individual i would have received if her/his need characteristics had been the same as that of the total sample or, to put it in another way, the ideal or reference medical care each individual should have received.

From m_i^* , and after having ranked the sample by income, it is possible to construct a need concentration curve ($L_N(R)$), which can be compared with the health consumption concentration curve $L_M(R)$ constructed from m_i .

The HI_{WV} inequity index represents twice the area between $L_N(R)$ and $L_M(R)$:

$$HI_{WV} = 2 \int_0^1 [L_N(R) - L_M(R)] dR = C_M - C_N, \quad (2)$$

where C_M and C_N are the concentration indices for real expenditure and need, respectively. If $HI_{WV} > 0$, when $L_N(R)$ lies above $L_M(R)$, the horizontal inequity favours the better-off, while a negative value, when $L_N(R)$ lies below $L_M(R)$, indicates that inequity favours the worse-off. If $HI_{WV} = 0$, there is no inequity, associated to the ability to pay, in the delivery of health care. This method enables the construction of disaggregated indices for each type of medical care, in order to identify those health care levels where inequality is concentrated.⁵ Following Kakwani et al. (1997), the HI_{WV} index can be alternatively calculated through a simple OLS regression, which also offers a standard error that can be used to conclude if inequity is significant or not.

⁵ Once the partial indices for the k health care services have been calculated, real and standardized total expenditure are expressed as:

$$m_{total} = \sum_k m_k \cdot c_k \quad \text{and} \\ m_{total}^* = \sum_k m_k^* \cdot c_k,$$

where c_k represents the cost per unit of each type of health care service consumed.

3. Data and estimation strategies

3.1. Data and variable definition

The data used come from the sample of adults (aged 16 or over) contained in the Spanish Health Interview Survey (hereafter SHIS) for 1997. The Health Interview Surveys are the only source of Spanish microdata which simultaneously contain information about the utilisation of health care services and about the state of individuals' health. Additionally, SHIS include information about type of health care coverage, lifestyles and demographic and socio-economic characteristics of individuals.⁶

The variables used in the computation of inequity represent both the need for and use of medical care. Traditionally, a three-need-component model has been used in most empirical studies [e.g. van Doorslaer et al. (1993)]. The first is a medical component, proxied by variables which indicate the presence of certain conditions; the second one is a functional component that indicate people inability to perform everyday vital functions and, finally, a subjective need component proxies health status by self-assessed health. The current study adopts this approach, by including all the relevant information from SHIS, apart from age and gender.

Identifying inequity at the different levels of health care services requires a separate analysis for each of the types of medical care available: visits to a GP, visits to a specialist, visits to the emergency services and number of hospital inpatient days in the most recent admission.⁷ SHIS information regarding consumption as a whole is incomplete. The SHIS for 1997 contains information about the most recent visit to the doctor. For emergency services, SHIS again reflect the characteristics of the last visit. Following Abásolo (1998), weights have been used to estimate how many “unknown” visits correspond to public GP/specialist visits and to public emergency visits. These weights, given in Table 1, correspond both to the proportion of public visits and the proportion of GP/specialist visits over the whole.⁸

⁶The sample interviewed does not include individuals in hospitals and other health institutions. Consequently, information about people with the highest need levels is not available. If this population group is the poorest one, their participation in consumption as a whole will be underestimated. However, the bias will be indeterminate because need and use variables are simultaneously ignored [O'Donnell et al. (1991)].

⁷ Drugs consumption and dental care are excluded from the analysis. In the former case, since the amount consumed is not available in the surveys. Dental care is excluded as it is, in general, a private health care service.

⁸ The number of visits has been rounded up to the nearest integer.

Table 1. Weights for ‘unknown’ visits.

	1997
Proportion of public visits (GP and specialist)	0.8528
Proportion of GP visits	0.7006
Proportion of specialist visits	0.2994
Proportion of public emergency services visits	0.9126

Need and use variables are defined in Table 2. Finally, some measure of the ability to pay is necessary, in order to calculate the concentration indices. Social class is used in this paper. Social groups have been defined from information available in the SHIS.⁹

⁹ Social groups are classified according to occupation, in line with Spanish Ministry of Health practice (1996). This classification takes into account several factors: the possibility of making comparisons with the British occupational classification, the need to make all surveys comparable and that of using groups of an adequate statistical size.

Table 2. Variables definition and descriptive statistics.

Variables	Definition	Mean	Std.Dev.	Min.	Max.
fairh	=1 if fair health (y)	0.226	0.418	0	1
poorh	=1 if poor health (y)	0.057	0.232	0	1
verypoorh	=1 if very poor health (y)	0.012	0.109	0	1
chronic	=1 if any chronic condition suffered (y)	0.291	0.454	0	1
reschr	=1 if chronic conditions restrict main activity (y)	0.075	0.264	0	1
12mlim	=1 if main activity restricted by non-chronic conditions (y)	0.180	0.384	0	1
acc	=1 if any accident suffered (y)	0.083	0.276	0	1
2wlim	=1 if activity restricted by any symptom (w)	0.112	0.315	0	1
ardays	Number of activity-restricted days (w)	0.684	2.521	0	14
beddays	Number of bed-days (w)	0.210	1.127	0	14
female	=1 if female	0.507	0.500	0	1
age2	=1 if $35 \leq \text{age} \leq 44$	0.170	0.375	0	1
age3	=1 if $45 \leq \text{age} \leq 64$	0.272	0.445	0	1
age4	=1 if $65 \leq \text{age} \leq 74$	0.111	0.314	0	1
age5	=1 if $75 \leq \text{age}$	0.060	0.238	0	1
GP	=1 if any visit to public GP (w)	0.149	0.356	0	1
NGP	Number of public GP visits (w)	0.180	0.467	0	5
ESP	=1 if any visit to public specialist (w)	0.042	0.201	0	1
NESP	Number of public specialist visits (w)	0.045	0.220	0	3
ER	=1 if any visit to public emergency services (y)	0.155	0.362	0	1
NER	Number of public emergency services visits (y)	0.224	0.683	0	14
HOSP	=1 if any publicly financed stay at hospital (y)	0.063	0.244	0	1
DAYS	Number of publicly financed inpatient days (y)	0.466	2.817	0	60

Note: (y) and (w) denote that the recall period is the previous year or the two previous weeks, respectively.

3.2. Estimation procedure

A central element in the computation of HIwv is the estimation of the standardized expenditure. Many studies have employed count data models in order to estimate demand for health care, since the dependent variable expresses the number of visits or number of inpatient days [e.g. Cameron and Trivedi (1986), Cameron et al. (1988), Pohlmeier and Ulrich (1995), Gerdtham (1997)].

Use of medical care is initially estimated using Poisson's basic model, which estimates the probability of a random variable Y taking a y value, so that:

$$\Pr(Y_i = y) = \frac{e^{-\lambda_i} \cdot \lambda_i^y}{y!}, \quad (3)$$

where y takes values 0, 1, 2...for the i individuals, and λ is the parameter to be estimated. If certain exogenous variables are introduced, $\lambda_i = \exp(X_i\beta)$, where X_i is the vector of exogenous variables and β the vector of parameters to be estimated.

The model above assumes that the mean and variance of Y_i are equal. However, if this assumption is not correct, standard errors are not consistent and tests may be distorted [Cameron and Trivedi (1990)]. In order to test the null hypothesis of equality between the mean and the variance the test proposed by Cameron and Trivedi (1990) is employed.¹⁰ If the null hypothesis is rejected, that is to say, if the dependent variable displays overdispersion, a more flexible distribution of probability is used, such as the negative binomial [Cameron and Trivedi (1986)]. This distribution is expressed as:

$$\Pr(Y_i = y) = \frac{\Gamma(y + v_i)}{\Gamma(y + 1) \cdot \Gamma(v_i)} \left(\frac{v_i}{v_i + \lambda_i} \right)^{v_i} \left(\frac{\lambda_i}{v_i + \lambda_i} \right)^y, \quad (4)$$

where $v_i = \left(\frac{1}{\alpha} \right) \cdot (\exp(X_i\beta))^k$, with $\alpha > 0$ and k is a constant.¹¹

After this first test, standard count data models are tested against hurdle models for count data based on the specification proposed by Mullahy (1986) in order to check whether consumption complies with a two-part decision-making process. This specification has been employed in several papers to estimate health care demand [e.g. Pohlmeier and Ulrich (1995), Gerdtham (1997)]. The contact decision is estimated by a probit, while the amount of medical care received conditional on contact having been made is estimated by using Poisson/negative binomial models truncated at zero, for that part of the sample which shows positive consumption.

In this context, however, the use of hurdle models gives rise to two kinds of problems [Pohlmeier and Ulrich (1995)]. First of all, if the dependent variable is censored in the truncated model, data corresponding to the first visit

¹⁰ The null hypothesis is expressed as $H_0: \text{var}(Y_i) = \lambda_i$, and the alternative hypothesis is that $H_1: \text{var}(Y_i) = \lambda_i + \alpha \cdot \lambda_i^2$. The test for overdispersion is a test of whether $\alpha = 0$. If α is not significant, the null hypothesis can be accepted.

¹¹ If $k=0$, the model above is the negative binomial II [Cameron and Trivedi (1986)]. This will be the specification used in the paper.

might be due to a previous illness period for which information is not available. This could be true for GP and specialist visits, since the recall period is quite short (the preceding fortnight). Additionally, long periods increase the probability of multiple illness episodes and ‘first contacts’. This second problem could affect the estimation of emergency visits. However, as long as the need variables for the different periods (two weeks and the whole year) are included in all the models, the above-mentioned effects will be controlled to some extent.

4. Main results

Table 3 reports the final estimations for medical care consumption, used to compute standardized consumption as a proxy of need.¹²

¹² The tables containing all the estimations and tests are available upon request.

Table 3. Estimation results from models of standardised consumption.

	GP VISITS				SPECIALIST VISITS		EMERGENCY SERVICES VISITS				INPATIENT DAYS			
	Probit		Neg.bin. truncated		Poisson		Probit		Neg.bin. truncated		Probit		Neg.bin. truncated	
Variable	Coef.	z	Coef	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z
fairh	0.244	4.378	0.466	2.134	0.976	5.766	0.261	4.417	0.591	2.788	0.301	4.050	0.145	0.909
poorh	0.459	4.843	0.663	2.541	1.048	4.413	0.446	4.589	1.191	4.139	0.311	2.778	0.588	2.863
verypoorh	0.209	1.180	0.284	0.637	1.258	3.567	0.382	2.119	1.351	2.743	0.198	0.945	0.520	1.252
chronic	0.264	4.794	0.078	0.390	0.585	3.669	0.195	3.283	-0.008	-0.037	-0.033	-0.420	-0.018	-0.103
reschr	-0.017	-0.198	-0.053	-0.247	-0.187	-0.943	0.219	2.506	0.357	1.259	0.096	0.910	-0.222	-1.112
12mlim	0.059	0.917	0.164	0.808	0.503	2.976	0.581	9.448	0.470	2.375	0.926	12.877	0.592	3.743
acc	-0.202	-2.371	-0.256	-0.867	0.199	0.998	1.091	16.288	-0.520	-2.580	0.230	2.593	0.139	0.817
2wlim	0.753	8.254	0.575	2.469	0.363	1.528	0.267	2.728	-0.105	-0.337	-0.137	-1.038	-0.864	-3.004
ardays	-0.011	-0.922	0.049	2.232	0.050	2.100	0.001	0.078	-0.010	-0.301	0.011	0.779	0.087	3.081
beddays	0.021	1.134	0.056	2.260	-0.002	-0.055	0.011	0.579	0.066	1.449	0.028	1.334	-0.017	-0.513
female	0.138	3.075	0.078	0.487	-0.084	-0.642	0.023	0.508	0.582	3.337	-0.023	-0.385	-0.098	-0.738
age2	-0.122	-1.699	0.009	0.032	0.300	1.532	-0.247	-3.632	-0.186	-0.713	-0.032	-0.357	-0.069	-0.335
age3	0.111	1.868	-0.067	-0.289	-0.082	-0.450	-0.437	-7.028	-0.512	-2.222	-0.149	-1.835	0.173	0.937
age4	0.325	4.373	-0.199	-0.730	-0.188	-0.829	-0.357	-4.401	-0.695	-2.341	0.020	0.202	0.492	2.379
age5	0.308	3.386	0.216	0.757	-0.530	-1.807	-0.626	-5.803	-0.552	-1.464	-0.056	-0.460	0.559	2.233
constant	-1.500	-31.772	-1.896	-8.673	-4.042	-25.673	-1.318	-29.397	-9.100	-0.338	-1.919	-30.412	1.085	6.276
lnalpha			-2.338	-1.239					8.312	0.309			0.043	0.271
alpha			0.097						4072.450				1.044	
n	5349		799		5349		5349		830		5349		339	
Pseudo R2	0.107		0.428		0.106		0.171		0.195		0.151		0.454	
Log Lik.	-2081.242		-381.451		-890.038		-		-668.175		-1072.112		-943.051	
							1914.522							
Overall % correct	87.03%						89.52%				93.37%			
Overdisp.(α)					-0.521	-0.416								
LR test ^a			76.758						216.710				233.757	

Notes: The function to be maximised in negative binomial models is not globally concave. Therefore, there is no guarantee of reaching a global optimal. For this reason several vectors of initial values were employed to start the maximum-likelihood procedure. Checks were made for all the models to ensure that estimations reached the same vector of parameters, irrespective of the vector of initial values used.^a The likelihood ratio test was employed to test the adequacy of the standard negative binomial model against the hurdle model. Given the number of independent variables, the result of $2 \cdot (\log L \text{ standard negative binomial} - (\log L \text{ probit} + \log L \text{ negative binomial truncated}))$ is distributed as $\chi^2(16)$.

As shown in the table above, hurdle models (consisting of a probit and a negative binomial truncated at zero) are the best option to estimate health care consumption in most cases. Therefore, standardized consumption must be calculated by employing the predictions from the hurdle model. There is, however, one exception. The model used to estimate the visits to a specialist represents a special case, since the dependent variable (NESP) only takes four values (0, 1, 2, 3). For this case, the hypothesis of equidispersion is accepted and a standard Poisson model is used to estimate consumption.

Table 4 reports need and expenditure concentration indices and the final HI_{wv} . The final column shows the t statistic, which indicates if inequity is significant or not. The first four rows correspond to partial expenditure. The overall imputed expenditure has been calculated as a weighted sum of partial consumption, where the weights reflect average costs nationwide.¹³

Table 4. Inequity indices (1997).

	$C_M^{(1)}$	$C_N^{(2)}$	HI_{wv}	$t - value^{(3)}$
GP	-0.1501(-5.975)	-0.1394(-6.302)	-0.0107	-0.362
Specialist	-0.1036(-2.175)	-0.0739(-6.399)	-0.0297	-0.520
Emergencies	-0.0698(-2.357)	-0.1335(-6.767)	0.0637	2.065
Inpatient days	-0.2117(-3.612)	-0.1317(-7.014)	-0.0800	-1.369
Overall expenditure	-0.1670(-4.772)	-0.1129(-7.452)	-0.0540	-1.607

⁽¹⁾⁽²⁾ t-values for concentration indices are given in parentheses.

⁽³⁾ This t-value has been calculated taking into account that C_M and C_N estimations are not distributed independently. For this reason it considers the serial correlation between the residuals, as proposed by Kakwani et al. (1997).

The need concentration indices reported in the table above indicates that need is, as expected, heavily concentrated on the worse-off. However, the amount of health care received by these individuals is also relatively high. In fact, the HI_{wv} indices reveal, except for emergency services, the presence of pro-poor inequity, although the t-values show that inequity is not significant.¹⁴ The results also suggest that inequity favours the rich in

¹³ Total costs have been calculated for a two-week period. Therefore, the cost of emergency visits and inpatient days has been multiplied by 1/26.

¹⁴ It is important to notice that pro-poor inequity, in this context, means that poor individuals consume more public health care than the rest of the population “with the same level of need”. This result does not

the distribution of urgent care in a significant way. Finally, the index for the overall imputed expenditure suggests a certain degree of pro-poor inequity. This index mainly reflects the average cost of hospital care, which represents the highest proportion of public health care expenditure.

The results for primary care (where barriers to access are not important) are consistent with those obtained from previous work (see Urbanos (2000)). However, the results concerning specialist visits are similar to those computed for 1995, but different from those calculated for 1987 and 1993 (for these years a certain degree of pro-rich inequity was detected). Further, the index for inpatient care shows also a different sign from previous results. Therefore, it could be concluded that a change in the distribution of specialised care has been produced during the latest years.

With regard to emergency services, the indices are similar to those obtained for 1987 and 1993. Although not significant pro-poor inequity was detected for 1995, the results of this paper reveal an increase of inequality affecting urgent care in the latest years.

5. Discussion of results and comparison with other European countries

The analysis performed tries to measure social inequalities in the distribution of public health care. However, it assumes that there are no differences in the quality or cost of health care received depending on patients' socio-economic level, which might be not true. Thus, inequity could be related to the quality of medical care and not to the amount. Further, as long as better health measures are developed and more (and better) information is available, it would be necessary to test the reliability of the results and to extend them over time.

In general terms, the Spanish results are similar to those obtained for other European countries that have applied the same method in the measurement of inequity. Van Doorslaer et al. (2000) present a comparison of horizontal equity in health care utilisation in 10 European countries and the US, which extends previous work. However, the analysis is not restricted to public health care. They also present disaggregated results by

imply that inequity in the distribution of "health" favours to the worse-off. In fact, the need concentration indices show that need is heavily concentrated on the poor.

different types of care: visits to a GP, visits to a specialist and hospital inpatient days.¹⁵

Van Doorslaer et al. find that, in general terms, the distribution of medical care is heavily concentrated on lower-income groups, especially for inpatient and primary care. For specialist visits, however, the consumption is more equally distributed among groups. The evidence for Spain is consistent with these results, as shown in the previous section.

With respect to the use of primary care, the results of this international study indicate that little or no significant inequity is found except in Belgium and Ireland. Van Doorslaer et al. suggest that the pro-poor inequity in these two countries may be due, among other factors, to the fact that lower-income groups are exempted from co-payments. In Spain, health care is delivered free of charge, except for drugs. However, patients with certain chronic conditions have to pay only 10 per cent of the cost, instead of the standard 40 per cent, and pensioners are exempted from this co-payment. This fact could explain at some extent that, for a given need, lower-income individuals tend to visit the GP more than higher-income individuals.

Regarding visits to the specialist, van Doorslaer et al. find significant pro-rich inequity in four of the six countries where visits to the GP and to the specialist were analysed separately. In particular, inequity appeared as significant in Belgium, Denmark, Finland and Netherlands, and not significant in Ireland and UK. However, the authors do not find an obvious system feature that could be linked to these differences among countries. It is suggested in the paper that ‘at any given level of need, higher-income better-educated individuals are more inclined to visit the specialist than lower-income individuals’ (p. 578). But it also may be possible that better-educated individuals are more frequently referred to the specialist with GPs acting as gatekeepers. The Spanish results, at least for some years, are consistent with this hypothesis.

Finally, results for inpatient care and for aggregate utilisation in most of European countries, as in the Spanish case, show pro-poor inequity but, except for UK and Belgium, the indices are not significant. The consolidation and improvement of the public health care services in

¹⁵ The European countries are Belgium, Denmark, Finland, West and East Germany, Ireland, Netherlands, Sweden, Switzerland and UK. Not all of them could disaggregate by GP and specialist visits.

Europe, most evident in the extension of population coverage, is one of the reasons that could be argued to explain these results.

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