



Regional Health Technology Assessment Agencies in Spain: How many are too many?

Desde mediados de los noventa han sido varias las agencias de evaluación de tecnologías sanitarias (ETS) creadas en España con el objetivo de fundamentar técnicamente la toma de decisiones respecto a la selección e incorporación de nuevas tecnologías en el sistema sanitario español, así como de ofrecer guías de prescripción a nivel regional. La nueva Ley del Medicamento 29/2006, de 26 de julio, puede abrir nuevas oportunidades en el área de la ETS para la consolidación y clarificación del papel de estas agencias regionales. España es el país con mayor número de agencias ETS afiliadas a la Red Internacional de Agencias de Evaluación de Tecnologías Sanitarias (INAHTA). Pero ¿cuántas son demasiadas? En este artículo investigamos los factores que pueden influir en el establecimiento de dichas agencias, utilizando el método estadístico de análisis de conglomerados para establecer grupos de países de la OCDE atendiendo a la presencia de agencias ETS, y de otras variables cuantitativas y cualitativas. El análisis nos arroja al menos tres mensajes claves: (1) un elevado gasto público sanitario y la existencia de un sistema sanitario descentralizado parecen favorecer el establecimiento de agencias; (2) España pertenece a un grupo de países federales de la OCDE caracterizado por un elevado número de agencias ETS operando a nivel nacional y regional; (3) las funciones y la coordinación de estas agencias para informar la toma de decisiones a nivel nacional debería ser objeto de evaluación y posiblemente reorientar su labor hacia una mayor especialización por áreas clínicas.

Since the mid-1990s a number of regional health technology assessment (HTA) agencies have been created in Spain to provide technical support to policy-makers on technology selection and implementation in the Spanish NHS and to offer regional prescribing guidelines. The New Medicines Act approved in July 2006 might open new opportunities in the area of HTA for the consolidation and the clarification of the role of these regional agencies. Spain is the country with the higher number of regional HTA agencies affiliated to the International Network of Agencies for Health Technology Assessment (INAHTA). But how many are too many? In this article we investigate the factors that can influence the setting up of HTA agencies, using hierarchical cluster analysis to identify groups of OECD countries according to the presence of HTA agencies, and other quantitative and qualitative variables. There are three key messages coming out of this analysis: (1) A high level of public expenditure in health and a decentralised decision-making context seem to favour the setting up of HTA agencies; (2) Spain belongs to a group of federal OECD countries with a high number of HTA agencies operating at a national and regional level; (3) the role and coordination of these agencies to inform national decision-making should be evaluated, and maybe oriented towards a higher specialisation by lead clinical areas.

Key words: health technology assessment, Spain, OECD, cluster analysis.

Yolanda Bravo Vergel, Senior Researcher, United BioSource Corporation (UBC).



Independent expert agencies with delegated powers on health care are currently operating in many OECD countries at national or sub-national levels. The established HTA organisations typically contribute to the governmental task on evidence-based policy and priority setting. The International Network of Agencies for Health Technology Assessment (INAHTA) currently comprises forty-five members from twenty-four countries, most of them OECD state members. In general terms, HTA organisations are responsible for the assessment of new and/or existing healthcare technologies regarding their effectiveness, appropriateness and/or cost-effectiveness. The phenomenon of the emergence of HTA agencies during the last two decades

seems to be in line with the growth of specialised agencies in Western countries. The growth of such specialised agencies can be explained by the fact that they are a means by which governments can solve credibility problems, committing themselves to regulatory strategies that would not be credible otherwise.^{1,2} In a broader sense, delegation of decision-making powers to independent agencies has been theoretically justified when there is a need for expertise in highly complex or technical matters and in order to free public administration from party political influence, providing greater policy continuity and greater flexibility in the application of policy to particular circumstances. The aim of the study is to investigate institutional and expenditure fac-

tors that can influence the establishment of HTA agencies in the context of the OECD. A selection of relevant political and health care system characteristics was explored using two non-parametric analysis techniques, hierarchical clustering and linear discriminant function analysis. This study also provides an up-to-date general overview of the presence of HTA organisations, and can help us understand whether Spain constitutes an exceptional case or, on the contrary, follows an established trend in the context of the OECD.

Background: Recent changes and challenges for HTA in Spanish health care system.

The Spanish health care system has undergone major changes since the approval of the Constitution (1978): the transition from a means-tested system of social security to a National Health Service with universal coverage, as defined by the 1986 General Health Care Act; the transition from an insurance-oriented system into a tax-funded system (1986 to 1999); the administrative and political decentralization of the health care system to the regional level (1981 to 2002); and finally, the introduction of the principle of regional fiscal co-responsibility (2001 fiscal reform), also applied to the national budget of health care.

The decentralisation of the state in Spain is mainly based on the concept of devolution (i.e. the responsibility for health care is transferred from the central administration to politically elected regions, in line with the basic constitutional structure of the country). Since 2002 the governance of the health care system is completely devolved to the 17 *Comunidades Autónomas* (autonomous communities, ACs), which hold planning powers, purchasing and provision as well as the capacity to organise their own health services in their regions. At central level, the Spanish Ministry of Health assumes responsibility for certain strategic areas, including general coordination and basic health legislation, definition of a benefits package guaranteed by the NHS, pharmaceutical policy (market authorisation, pricing and reimbursement) and training and research.

Since the mid-1990s a number of regional health technology assessment (HTA) agencies have been created in Spain to provide technical support to policy-makers on technology selection and implementation in the Spanish NHS and to offer regional prescribing guideli-

nes. The Institute of Health Carlos III is in charge, among other responsibilities on training and research, of HTA activities at a national level. The institute performs these functions through the Agency for Assessment of Health Technology (Agencia de Evaluación de Tecnologías Sanitarias, AETS). Among other functions, AETS is responsible for the coordination of HTA activities in Spain.³ The list of agencies developed at a regional level and affiliated to INAHTA is extensive:

- OSTEBA - Basque Office for Health Technology Assessment (1992)
- CAHTA - Catalan Agency for Health Technology Assessment and Research (1994)
- AETSA - Andalusian Agency for Health Technology Assessment (1996)
- AVALLIA-T - Galician Agency for Health Technology Assessment (1999)
- UETS - Unit for Health Technology Assessment (2003)

The New Medicines Act approved in July 2006 might open new opportunities in the area of HTA for the consolidation and the clarification of the role of these regional agencies, in terms of their functions, methodology, accountability in the health system and the implementation and impact of their reports on prescription and cost-containment.

Methods

Multivariate analysis is a collection of techniques appropriate for situations in which the random variation in several variables has to be studied simultaneously.^{4,5} Cluster analysis classifies a set of observations into two or more unknown groups, that both minimize within-group variation and maximize between-group variation. We decided to perform a hierarchical cluster analysis, mainly because this method does not require prior knowledge of the number of groups.

The groups defined by hierarchical cluster techniques are nested rather than being mutually exclusive and represented by a two-dimensional diagram known as a *dendogram*, which illustrates the fusions that occur at each successive stage of the analysis. In this study agglomerative methods are used, so variables were successively fused from 30 separate cases (OECD countries) into a single cluster containing all of them. In order to measure the distances between observations and build up a proximity matrix, we chose one of the most commonly used methods, the squared Euclidean distance, in which the distance between

two observations is the sum of the squared differences between their values. Once the proximity matrix was constructed, we used the *average linkage* method to divide the countries into groups based on these distances.

In the second stage, a linear discriminant function analysis was performed using the optimal number of groups predicted by the cluster analysis. The object of the analysis is to find the linear combination of predicting variables which best discriminates among the groups. This non-parametric analysis approach is based on Fisher's linear discriminant function, which looks for the *linear function* that maximizes the ratio of the between-groups sum of squares (SSq) to the within-groups SSq.⁶

Data sources

The data sources used for the analysis were the OECD Health Data (2004)⁷ and the authors' own research based on a literature review, mainly Health Care Systems in Transition (HiT) country profiles published by the European Observatory on Health Care Systems⁸ and recent OECD reports.^{9,10} We also used the INAHTA database of HTA member profiles.¹¹

Framework of variables

A number of variables consistent with the research question were chosen as the basis for the analysis. All variables were used for both types of analyses, with the exception of the number of HTA agencies present in the country, not used in the discriminant function analysis as this is the phenomenon we want to explain. The framework of variables is shown below, the numbers in brackets relate to the values of the categorical variables:

- a. **Number of HTA agencies** operating in the OECD, identified using the INAHTA database. All members affiliated are non-profit organisations, related to regional or national governments and funded at least 50% by public sources.
- b. **Expenditure** variables, which measure the level of financial commitment each state has towards health care. Data collected were public expenditure on health care and public expenditure on pharmaceuticals. Both are continuous variables and measured as a percentage of national GDP.
- c. **Health care system** variables, which provide a simplified description of their structure and organisation. The form of health care decentralisation, categorised as (1) centralised system, (2) deconcentration, and (3) devolution was operationalised using

Collins's typology.¹² Based on secondary sources, we classified all health care systems in the continuum centralised - devolved systems, according to the legal responsibilities of their territorial authorities. Based on Gordon's typology¹³ and the study by Saltman et al.¹⁴ we classified the OECD health systems into three main different types: (1) National Health Service, NHS; (2) Social Health Insurance systems, SHI; and (3) mixed systems, defined as countries with means-tested health programmes and others.

d. **Principal shared-rule arrangement in the country**, which together with the form of health care decentralisation gives us a measure of the level of decentralisation of the decision-making context. By definition, devolution means the existence of quite distinct levels of government in the country, and probably the existence of federal arrangements in the territorial distribution of power. In order to differentiate the influence of both factors, we included the principal shared-rule arrangement in the country as a separate variable. As long as the proper power relations are developed, a wide variety of political structures can be consis-

tent with federal principles. According to Watts¹⁵ and Elazar's¹⁶ description and classification of the existing forms of self-rule and autonomy across the world, we have categorised all OECD countries into (1) unitary states, (2) countries with federal arrangements and (3) federations.

See Table 1 below for further details. The statistical analyses were performed using SPSS v.11.

Results

The results of the cluster analysis containing all variables are shown in the dendrogram (Figure 1). Examination of the dendrogram indicates that a three-cluster solution could be optimal, at a rescaled distance of approximately 20. The distances of the far branches are small relative to the near branches, so the grouping seems to be quite effective. The resulting groups are:

Group 1: Poland, Turkey, Korea, Ireland, Luxembourg, Greece, Slovakia and Mexico.

Group 2: Norway, Sweden, Denmark, Iceland, Germany, Australia, Switzerland,

Austria, Finland, Japan, Portugal, Italy, Belgium, New Zealand, Czech Republic, Hungary and France.

Group 3: Spain, UK, Canada, USA and the Netherlands.

Group 1 comprises eight countries. In all cases, their national public health expenditure is below the average of the OECD (6.04% GDP). However, in contrast, their national public expenditure on pharmaceuticals is closer to the average (0.85%), with remarkable exceptions like Slovakia, with expenditure equal to the 1.8% of their GDP. They are all unitary states, with the exception of Mexico, and their health care systems are very centralised, only administratively deconcentrated in some cases. None of these countries has a HTA agency in place. Group 2 is made up of a rather heterogeneous group of countries, including all the Scandinavian countries, some of the members of the G-7 and some Central and Eastern European countries. This is the most numerous group, seventeen countries, and all of them have a limited number of HTA agencies, one or two at the most, with the exception of Iceland, Japan, Portugal and Italy which have no agency in place. Their

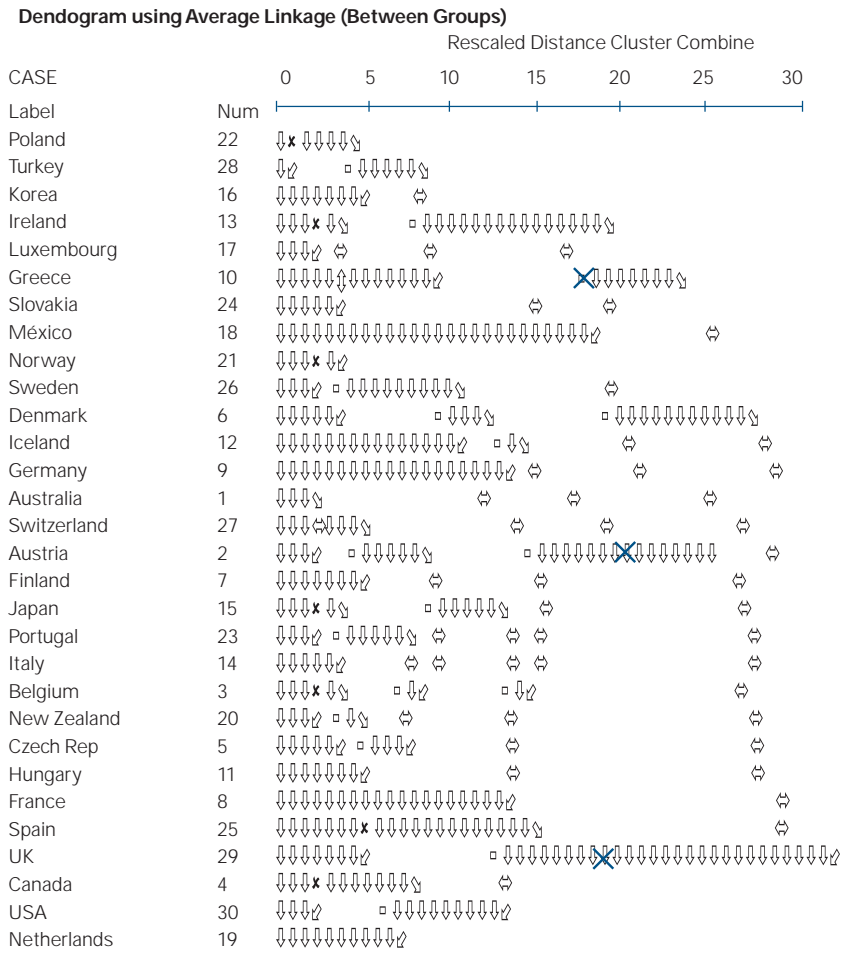
Table 1. TABLE OF PARAMETERS

Country	No. INAHTA Agencies	Type of health care system	Decentralisation health care system	Form political decentralisation	Public health expenditure (%GDP)	Public expenditure on pharmaceuticals (%GDP)
Australia	2	SHI	Devolution	Federation	6.2	0.7
Austria	1	SHI	Devolution	Federation	5.4	0.9
Belgium	1	SHI	Deconcentration	Fed. arrang.	6.5	0.7
Canada	3	SHI	Devolution	Federation	6.7	0.6
Czech Rep	1	SHI	Deconcentration	Unitary state	6.8	1.3
Denmark	2	NHS	Devolution	Fed. arrang.	7.3	0.4
Finland	1	NHS	Devolution	Fed. arrang.	5.5	0.6
France	2	SHI	Centralised	Fed. arrang.	7.4	1.4
Germany	1	SHI	Centralised	Federation	8.6	1.2
Greece	0	NSH	Centralised	Unitary state	5	1
Hungary	1	Mixed	Deconcentration	Unitary state	5.5	1.3
Iceland	0	NSH	Deconcentration	Unitary state	8.3	0.8
Ireland	0	SHI	Deconcentration	Unitary state	5.5	0.7
Italy	0	NHS	Devolution	Fed. arrang.	6.4	1
Japan	0	SHI	Deconcentration	Fed. arrang.	6.4	1
Korea	0	Mixed	Centralised	Unitary state	3.2	0.7
Luxembourg	0	SHI	Centralised	Unitary state	5.3	0.6
México	0	Mixed	Deconcentration	Federation	2.8	0.1
Netherlands	3	SHI	Deconcentration	Fed. arrang.	5.5	0.6
New Zealand	1	Mixed	Deconcentration	Fed. arrang.	6.6	0.8
Norway	1	NHS	Devolution	Unitary state	7.4	0.4
Poland	0	Mixed	Deconcentration	Unitary state	4.4	0.7
Portugal	0	NSH	Deconcentration	Fed. arrang.	6.5	1.3
Slovakia	0	SHI	Deconcentration	Unitary state	5.1	1.8
Spain	5	NSH	Devolution	Federation	5.4	1.2
Sweden	2	NSH	Devolution	Unitary state	7.9	0.8
Switzerland	11	SHI	Devolution	Federation	6.5	0.8
Turkey	0	Mixed	Deconcentration	Unitary state	4.2	1
UK	5	NSH	Devolution	Fed. arrang.	6.4	0.7
USA	3	Mixed	Devolution	Federation	6.6	0.4

Sources: OECD Health Data (2004)⁷ and authors' own research based on a literature review. Expenditure figures shown belong to latest data available per country.

NHS: National Health Service; SHI: Social Health Insurance system; Fed. arrang.: federal arrangements (i.e. associated states, federacies, unions and constitutionally decentralized unions). The Spanish State of Autonomies is defined by Elazar as a "quasi-federation" and a "federal state in all but name" (Elazar 1994:223). For a complete description of federal political systems see Watts 1999¹⁵ and Elazar 1994¹⁶.

Figure 1. DENDROGRAM FOR OECD COUNTRIES USING HIERARCHICAL CLUSTER ANALYSIS



national public health expenditure is above the average of the OECD, with the exception of only two countries. Their national public expenditure on pharmaceuticals is close to the OECD average, with the exception of some of the Scandinavian countries, which are in fact below the average (Norway, Finland and Denmark). There is not a clear pattern regarding their type of health care system: about one-half are NHS and the other half SHI systems. Most of the countries are federations or have some kind of federal arrangement, and half of them have deconcentrated health systems.

Group 3 includes some of the historical federal systems (USA and Canada). This is the smallest and most homogeneous group of countries in the overall classification. Their national public health expenditure is above or around the OECD average, although their national expenditure on pharmaceuticals is below the average, with the exception of Spain. All countries are federations or have

some kind of federal arrangement, and all of them have devolved health care systems, with the exception of the Netherlands, defined as a deconcentrated system. There is not a clear pattern regarding the type of health care system: about one-half are NHS and the other half SHI systems. This group of countries has three or more HTA agencies registered at INAHTA, with the extreme cases of the UK and Spain, which at the time of the analysis had five registered organisations each.

In order to undertake the discriminant function analysis, a *grouping variable* was created based on the three groups identified in the dendrogram and already described. Table 2 contains the discriminant function coefficients for the interaction terms. The magnitude of the standardized coefficients conveys the importance of the contribution from each variable in predicting the grouping variable.

The three variables that have the largest coefficients for the first canonical function

(F_1) are the public expenditure on health care (0.861), the principal shared-rule arrangement in the country (0.553) and the form of decentralisation of the health care system (0.316). For the linear function 2 (F_2), again, the public health care expenditure (0.481), followed by the public health care expenditure on pharmaceuticals (0.272) and the type of health care system (0.189) show the most important contributions.

Results of the multivariate tests of significance show that three out of the five variables (corresponding to those with the largest coefficients for F_1) indicate that there are significant differences between the three groups of countries. For the linear function F_1 there is also sufficient evidence to reject the null hypothesis that the means of the predicting variables do not differ for the three categories of the grouping variable. However, this is not the case for F_2 : two of the main predicting variables are not significant (public expenditure on pharmaceuticals, $p=0.530$; and type of health care system $p=0.112$), and the function is not significant itself ($p = 0.374$).

The fact that the F_2 is not significant may be due to the fact that if most of the variation between groups has already been explained by F_1 , the ratios of SSQ corresponding to subsequent functions would be relatively small. However, the degree of prediction of the original five variables collectively is rather important: 83% of cases were correctly classified, and the territorial map shows a division of the 30 countries in two clearly-delimited areas, roughly approximated by a straight line (see Figure 2). As the scatter plot shows, F_1 divides the data clearly into two sections: countries that have and do not have HTA organisations. It is obvious that the discriminatory power of F_2 is not as good as that of F_1 .

When considering the information provided in the scatter plot, these results corroborate the hypotheses that we previously formulated based on the clusters. Countries placed on the left of the F_1 axis, with a low level of public health care expenditure, without federalist arrangements and centralised health care sys-

Table 2. STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	Function	
	1	2
Public expenditure	.861	.481
Public exp on pharma	.116	.272
Type health care system	-.062	.189
Form political decent.	.553	-.592
Decent health system	.316	-.195

Table 3. MULTIVARIATE TESTS OF SIGNIFICANCES

Test of Equality of Group					
	Wilk Lambd	F	df1	df2	Sig
Public expenditure	.430	17.928	2	27	.000
Public exp on pharma	.954	.650	2	27	.530
Type health care system	.851	2.372	2	27	.112
Form political decent	.701	5.765	2	27	.008
Decent health system	.623	8.166	2	27	.002

Wilks' Lambda					
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig	
1 through 2	.251	34.551	10	.000	
2	.844	4.245	4	.374	

tems, have a greater probability of not having any HTA organisation, and so belong to group 1 of our classification. Only Hungary was misclassified, predicted to belong to group 1 although it has a HTA operating, and was classified as belonging to group 2 in the cluster analysis. In contrast, countries placed on the right of the F₁ axis (groups 2 and 3) share the characteristics of higher levels of public expenditure in health care, the presence of some federal arrangement in the country and more decentralised health care systems.

Countries placed on the left of the F₂ axis, with a high level of public health care expenditure and public expenditure on pharmaceuticals, have a greater probability of having a limited number of HTA agencies (group 2). Group 3 countries are placed on the right of the F₂ axis, and all share lower levels of public expenditure and also on pharmaceuticals. All five members of this cluster were correctly classified.

Discussion

Cluster analysis comprises a range of methods for classifying multivariate data into sub-groups, revealing the characteristics of any structure or patterns present. These techniques have been employed in a diverse range of disciplines (such as biology, botany, medicine, psychology and others) but the method is generally applied to produce classifications at the individual level.

This paper has reported on the utilisation of hierarchical cluster analysis in conjunction with linear discriminant function analysis as a useful tool in the study of health care systems, particularly for generating hypotheses. See Nixon¹⁷ for another applied study in this area.

This work also represents an attempt to synthesise the complex reality of HTA organisations among OECD member countries.

Despite the great diversity of formulae for the decentralisation of health care systems and for the territorial division of power, this research shows that there is scope for simplification and operationalisation of these complex variables.

The main limitation of the study is that there is always a certain degree of subjectivity in the choice of linkage methods and the interpretation of the cluster solutions using the dendrogram, and for this reason results need to be considered with caution. Here we used the most common methods for standardisation and inter-group linkage, and the robustness of the results was assessed trying different distance measures and linkage methods. Also, partly with the objective to test the internal validity of the results, cluster analysis was used in conjunction with discriminant function analysis.

The distributional assumptions for traditional discriminant analysis, for example that the sample is multivariate normal, are clearly not satisfied. However, it is common practice to

employ the above procedures, at least as a first analysis, since the method can be seen to produce satisfactory results even for scenarios where the distributional assumptions cannot be met.¹⁸ The primary division into groups of countries that have and do not have a HTA agency is seen to be statistically significant. However, there is less clear success in discrimination at the second level, in the continuum of countries with a limited or high number of HTA organisations.

Finally, although all affiliated members to INAHTA are non-profit organisations, related to regional or national governments and funded at least 50% by public sources, they show interesting variations in terms of: (1) their legal status (public research institutes, research councils within governmental departments, civil service organisations, independent governmental agencies) and accountability in the healthcare system; (2) their primary aim (identifying and commissioning relevant technology assessment research, formulating advice, supporting evidence-based policy, offering prescribing guidelines); and (3) the level of enforcement of their respective reports or guidances.

In this sense, although INAHTA was the most comprehensive international database available, results should be interpreted with caution given the broad definition of what constitutes an HTA agency.

The results of this research highlight some factors that influence the setting up of HTA agencies. The level of public expenditure in health care is the variable that seems to contribute the most to the grouping. In the context of comprehensive health-related social insurance systems, this is an intuitively reasonable

Figure 2. ALL-GROUPS SCATTER PLOT WITH MISCLASSIFIED COUNTRIES

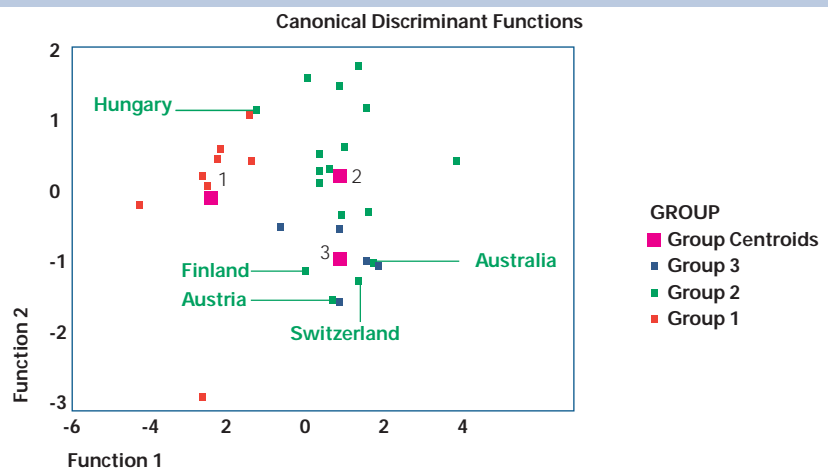


Table 4. PREDICTED GROUP MEMBERSHIP AND MISCLASSIFICATIONS**Classification Results^a**

	GROUP	Predicted Group Membership			Total	
		1	2	3		
Original	Count	1	8	0	8	
		2	1	12	17	
		3	0	0	5	
	%	1	100.0	.0	.0	100.0
		2	5.9	70.6	23.5	100.0
		3	.0	.0	100.0	100.0

^a 83,3% of original grouped cases correctly classified.

result. As the public expenditure needed to finance the system increases, not only the size of the problem but also public awareness can put pressure on incumbent governments to take a political decision about explicit rationing.

The form of decentralisation of the health care system and the presence of federal arrangements in the country also appear to be relevant. In particular, it is striking that twelve out of the eighteen countries with HTA agencies currently operating have devolved health decision-making authority to regional or local governments. In the context of shared accountability it should be easier to take unpopular rationing decisions. At the same time, national HTA agencies have the potential to be used as an indirect control mechanism to

address issues of inter-territorial equity and control of public expenditure, particularly problematic in a context of decentralisation.

Spain belongs to a group of federal OECD countries with a high number of HTA agencies operating at a national and regional level. This group of countries has three or more HTA agencies registered at INAHTA, with the extreme cases of the UK and Spain, which at the time of the analysis had five registered organisations each. However, in the case of the UK four out of the five agencies affiliated are academic units based at Universities (Birmingham, Southampton, York) that provide services to the UK NHS via NICE and the HTA programme, carrying out important dissemination activities and serving the whole nation or at least the English and Welsh popu-

lation. In this sense, the case of Spain is paradoxical as all the agencies currently operating are non-profit public agencies affiliated to a regional health service, and serving the corresponding population of the AC (with the exception of the national agency AETS, set up at the Institute of Health Carlos III).

The agencies taking the lead of HTA in Spain have been operating for over a decade now. Maybe it is time to undertake a critical exercise of self-evaluation to improve working methods and performance and ask whether the presence of such a high number of agencies is operative and represent an efficient use of scarce economic and professional resources; whether the proliferation of regional HTA agencies in Spain is justified in terms of the quantity and the quality of scientific production and, even more important, of their dissemination activities and the impact of their technical services and briefings on cost-containment and policy-making; and finally, whether their level of coordination and their relationship with the academia and the pharmaceutical and medical technology industry could be more productive and self-reinforcing. In this sense, the *New Medicines Act* recently approved might open new opportunities for the consolidation of the role of these agencies and the efficient use of HTA evidence in our country.

Acknowledgments

We would like to thank Professor Brian Ferguson, University of York, for his valuable contribution and Dr Robert West, University of Leeds, for his advice on the statistical analysis. We are also grateful to Dr. John Nixon, Centre for Reviews and Dissemination, for his comments on an earlier draft of this paper.

References

- Majone G. *Regulating Europe*. London: Routledge, 1996
- Majone G. Independent agencies and the delegation problem', in Steunenberg B and Van Vught F (eds). *Political Institutions and Public Policy: Perspectives on European Decision Making*. Dordrecht: Kluwer Academic Publishers, 1997
- Durán A, Lara J, van Waveren M. *Spain. Health Systems in Transition*, vol. 8(4). Copenhagen: WHO Regional Office for Europe, 2006.
- Armitage P. *Statistical Methods in Medical Research*. Oxford: Blackwell Scientific Publications, 1971
- Everitt B, Landau S and Leese M. *Cluster Analysis*. 4th ed. London: Arnold Publishers, 2001
- Mardia KV, Kent JT and Bibby JM. *Multivariate Analysis*. London: Academic Press, 1979
- OECD/CREDES *OECD Health Data 2004. A Software for the Comparative Analysis of 30 Health systems*. Paris: OECD/CREDES
- European Observatory on Health Care Systems, <http://www.euro.who.int/observatory>
- Colombo F and Hurst J. *Review of the Korean Health Care System*. Paris: OECD, 2002
- Jeong H. and Hurst J. *An Assessment of the Performance of the Japanese Health Care System*. Occasional papers 56. Paris: OECD, 2001
- INAHTA database member profiles, <http://www.inahta.org>, accessed May 2005.
- Collins Ch. *Management and Organisation of Developing Health Systems*. Oxford: Oxford University Press, 1994
- Gordon MS. *Social Security Policies in Industrial Countries*. Cambridge: Cambridge University Press, 1988
- Saltman RB, Busse R and Figueras J. *Social Health Insurance Systems in Western Europe*. European Observatory on Health Care Systems Series. London: McGraw-Hill Education, 2004)
- Watts RL. *Comparing Federal Systems*. 2nd ed. Kingston: McGill-Queen's University Press, 1999
- Elazar DJ. *Federal Systems of the World. A Handbook of Federal, Confederal and Autonomy Arrangements*. Essex: Longman Group Limited, 1994
- Nixon J. *How does the UK NHS compare with European standards? A review of EU health care systems using hierarchical cluster analysis*. University of York, CHE Discussion Paper 2000; 182.
- Asparoukhov O and Krzanowski WJ. *A comparison of discriminant procedures for binary variables*. *Computational Statistics and Data Analysis* 2001; 38:139-160