Title: Equity and efficiency priorities within the Spanish health system: A discrete choice experiment eliciting stakeholders preferences

Running Title: Priority setting in the Spanish health system

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Abstract

Background: The trade-off between efficiency and equity has been largely studied in the health economics literature and for countries with different types of health systems. Even if efficiency and equity are desired, it is not always feasible to attain both simultaneously. In Spain, the National Health System has historically been recognized for its universal access and free of charge provision, with good health outcomes. However, the recent increase in health expenditures together with the economic cycle has turned the orientation of health policy implementation towards efficiency, threatening universality and equity in the access to healthcare.

Methods: A Discrete Choice Experiment was carried out to weigh priorities of policy-makers from different regions in Spain. A total of 69 valid questionnaires were collected and the preferences towards equity and/or efficiency criteria were evaluated. Composite League Tables (CLTs) were used to rank hypothetical health interventions based on their attributes.

Results: The Spanish health policy-makers, managers and other stakeholder displayed a stronger preference for severity of disease, high individual benefits, a large number of beneficiaries and proven cost-effectiveness criteria in decision making. The priority interventions targeted severe mental disorders, i.e. major depressive disorders and suicides (or suicidal attempts), especially for young and middle age categories across the three regions under study.

Conclusion: In times of economic crisis, health policy-makers, managers and other stakeholder value, in moderation, efficiency over equity. The impact of austerity measures on populations' socio-economic wellbeing seems correlated with the preference for mental health interventions.

Keywords: Discrete choice experiment, priority setting, MCDA, policy-makers, mental health, Spain.

Background

The allocation of health care resources in times of scarcity represents one of the greatest challenges in modern economies(1). Policy-makers are forced to balance decisions between two objectives: the "maximization of a population's total health gain (efficiency objective) and the minimization of inequalities (equity objective)". In this study, population-level health gains are defined by the unweighted sum of all individuals' health gains. In the light of limited health care budgets, choices entail a trade-off between efficiency or equity. In the pursuance of finding the optimum choice in the respective setting, policy-makers weigh out priority criteria in health care (2). The transparency and understanding of policy-makers' preferences have become a major public interest, particularly in countries affected by the economic crisis (3, 4). Strategies of health care planning and policy implementation affect a population on both the macro level (overall health gain) and micro level (individual health), enhancing the demand for replicability of policy-maker's priority setting from multiple interest groups including pharmaceutical companies, insurance schemes, health care providers or individual citizens (1).

In practice, decisions on the dissemination of health care goods are commonly ad hoc, based on heuristic approaches (5). The underlying problem is that, although information is provided by multiple disciplines, including public health, social sciences and evidence-based medicine, it is inadequate to form complex decisions on priority setting in the absence of clear and specific guidelines targeting common goals. Within an environment of continuously increasing health care needs and costs, decision-making ought to be based on more rational and transparent approaches.

Thus, a transparent and explicit method in priority setting is needed, particularly in times when the economic cycle threatens the sustainability of a health care system (1, 6). A holistic view of the available information and knowledge of the relationships between the various characteristics of a health system should be the basis for formulating and implementing policies, which have the desired effect.

Discrete choice experiments (DCEs) are a convenient and effective tool that enhances such analyses. The DCE approach belongs to a broader methodology used for rational priority setting, called multi-criteria decision analysis (MCDA). Compared to other methods, DCEs allow for the utilization of all

available information, as well as for comparisons between the different criteria (3). By eliciting stakeholders' preferences regarding multiple criteria simultaneously, MCDA offers valuable guidance in explicit decision making and has gained ground as a tool to inform decisions on health care resource allocation (3).

The Spanish Constitution (1978) enacted the National Health Systems based on a universal coverage, publicly funded, with a free of charge provision and some co-payment of pharmaceuticals related to age and income. The universal coverage was completed in 1989, concurrently with the devolution of health competencies to the seventeen Autonomous Communities (AC) between 1981 and 2005 (7), including regional autonomy in the organization and delivery of health services. Recently, 92.4% of the public health expenditures were executed by the ACs (8). In 2010, economic austerity measures included a 5% decrease in wages for public workers, freezing of pensions, and tax increases. In 2011, the Catalan government approved cost-containment measures such as the reduction in the budget of public hospitals (average 8.5%), the closure of primary health centres and outpatient centres, delayed or halting new health care infrastructure, and reduction of interim health practitioners (6). Similar measures were imposed in other ACs. Overall, the total national health expenditure per capita fell from US$3072 in 2008 to US$2658 in 2014, a reduction of 13% (9). Globally, there has been a convergent interest to shed light upon policy-makers preferences and to find a transparent and rational approach in priority setting, particularly in times of economic recessions inducing compounded scarcity of resources (10, 11). Hence, in the context of the Spanish health care system, the assessment of preference criteria in priority setting is crucial to creating a basis for a consensus, so that policy-makers are prepared for current and future challenges.

We aim to assess the preferences of stakeholders in the Spanish health care system in times of economic recession. A DCE was implemented to elicit preferences of stakeholders towards equity and/or efficiency across five ACs: Cantabria/Valencia, Madrid and Catalonia/Basque Country. Subsequently, to investigate whether priorities for health interventions met the health care needs produced by the economic crisis, a rank order of health interventions according to individual preferences was compiled by mapping interventions to these criteria in a Composite League Table (CLT).

Methods

1.1. The context of the experiment

Respondents were asked to choose between pairs of health care interventions. Each intervention was defined in terms of criteria related to levels of equity and efficiency. There has been a great debate on which criteria should be taken into consideration when decisions on resource allocation are made (4, 12-17). The definition and selection of these criteria should enhance accountability, acceptability and credibility in the society. In these terms, the criteria chosen for this experiment offer the most relevant information and can be grouped into two major categories, those of equity and efficiency (4, 12-17). For the purpose of this study, we are applying the concept of technical efficiency defined as the maximal health gains for the least cost. The main attributes include individual health benefits, the number of potential beneficiaries and cost effectiveness analysis. Equity is defined as the absence of systematic disparities in health between social groups, and the attributes selected include severity of disease, willingness to subsidise others and age of target group.

The DCE attributes selected and design follow recent studies and are based on existing literature (2, 4, 5, 10, 17, 18). Criteria are identified as context-relevant and consistent with the properties of completeness, feasibility and mutual independence required for the experimental design. **Table 1** summarises criteria definitions and their levels, while an example of a choice scenario is given in Appendix A. A detailed description of the respondents' characteristics is given in **Table 2**.

[Insert Table 1]

[Insert Table 2]

1.2. The design of the experiment

For this experiment, five criteria of two levels and one criterion of three levels are used. Therefore, the total number of unique combinations is 96 (i.e. $2^5 * 3^1=96$). We used Sawtooth Software to select 32 unique alternatives for a fractional factorial design. These alternatives were then randomly as

signed into 16 pair comparisons, in order to represent an orthogonal array. This design ensured that the effects of individual criteria will not be confounded, meaning that the variations of the criteria are uncorrelated in all choice sets.

1.3. Data collection

The formulated questionnaire was presented at two health economics events in Spain: the Spanish Health Economics Association Meeting in May 2011; and the Encounter of the Drug Industry in September 2011. The attendees of these events were mostly policy-makers, public health managers, academic researchers, and representatives of the pharmaceutical industry. 150 copies of the questionnaire were delivered in these events, while 100 more copies were sent to Spanish health economists at various Regional Health Services. These regions included Valencia, Cantabria, Madrid, the Basque Country and Catalonia. Given the socio-demographic characteristics of the ACs, we regrouped these into three different regions for the analysis: Catalonia/Basque Country, Cantabria/Valencia, and Madrid. During the following months, a monitoring of these regional services took place. A detailed presentation of the study goal preceded the experiment. At the same time, guidance in understanding and dealing with the questionnaire was provided in both the events and the sent copies. Once the completed questionnaires were received, several had to be dropped from the analysis due to invalid answers. Even more, two questionnaires were excluded for being incomplete.

1.4. Data analysis

For estimation purposes, we utilized an additive linear utility model where the individual utility derived from an alternative is decomposed into two additively separable parts: a systematic part explained by the characteristics of the alternative and an error term assumed to be Gumbel independent and identically distributed. This random utility formulation errors gives rise to McFadden's conditional logit model (CLM) (19).

The data analysis was implemented using the statistical software Stata. Interaction terms between criteria and socio-demographic characteristics were included in the utility function to capture observed heterogeneity in respondents' choices. In CLMs, the assumption of IID errors leads to the Independence of Irrelevant Alternatives (IIA) property, which although simplifying the estimation procedure, has some essential disadvantages. That is, the observed and unobserved characteristics of utility are not always independent and/or the random components of utility are often correlated with each other. In these cases, the IIA assumption is violated and the MNL results are biased (20). Unobserved heterogeneity was incorporated and modelled through a Mixed Logit Model (MXL).

Goodness of fit comparisons between CLM and MXL models were assessed through information criteria (i.e. Bayesian, BIC, and Akaike, AIC). Backward selection (at the 0.10 significance level) was used to choose the variables to be included and reach a final model specification.

Finally, in order to account for potential regional diversity in priority setting, three sub-models were estimated, one for each of the three regions included in the study. Before separating the model, some assumptions had to be tested. In particular, the IID property implies that the error terms are not only independent of each other but also identically distributed among alternatives, thus homoskedastic. That is, the error variances (or equivalently the inversely related scale parameters) are equal across alternatives and individuals (21). Therefore, in order to obtain efficient parameter estimates from the sub-models, the scale factors should not be significantly different. To test this assumption, a heteroskedastic conditional logit model (22) was used to establish whether differences in scale parameters between the three regions are not significant, hence the model is separable.

For a meaningful interpretation of the magnitude of the estimated parameters, percentage differences in predicted probabilities were calculated for each criterion. Once parameters were estimated, the predicted probability of a base case alternative was calculated (i.e. an alternative where all criteria are set to their mean values). Next, one of the criteria was set equal to 1 and again the predicted probability was obtained. The two probabilities were then compared and their percentage difference was calculated. We repeated this procedure one by one for each criterion so that we obtain an implicit ordering of the relative importance of each criterion according to its impact on the probability of choosing each alternative (23).We applied the same methodology to all the three regions.

Further, in order to assess the relative weight of efficiency over equity criteria, we calculated percentage changes for the aggregate equity and efficiency criteria. That is, predicted probabilities are again computed for each case, by setting first all equity and then all efficiency criteria equal to 1 simultaneously. Next, the percentage changes between the aggregate probabilities and the base case alternative were calculated. These percentage differences were then used to construct an equity/efficiency ratio, which is an estimate of the equity/efficiency trade-off. Given the three mutually exclusive levels of “age of target group” criterion, three different calculations had to be implemented, one for each level. For the remaining criteria, being binary, this last step was not necessary. Finally, three different computations were performed, one for each of the regions.

1.4.1. Composite league table

As a last step we examine the broad classification and ranking of health interventions within the context of specific clinical conditions and country-specific policy questions (i.e. composite league table, CLT). That is, health interventions across several disease areas that are of interest in Spain are rank-ordered in order to give a further insight for the determinants that affect priority setting. We utilize the burden of disease in high-income countries to select the disease areas and risk factors included in the construction of the CLT. These data was originated in reports on non-communicable diseases and health policy from WHO and some other partner institutions (24, 25)[40-43]. Then we mapped primary/secondary preventive and inpatient/outpatient therapy interventions treating such clinical conditions and risk factors on the experiment's criteria and levels.

Based on the coefficients estimates, we then defined a "composite index" score (CI) for each intervention, establishing its relative priority as a function of its characteristics (2). In other words, CI scores were calculated based again on a linear additive utility model, but in this case the different health interventions were the alternatives. According to the CI results, interventions were ranked in the CLT. As before, the three age categories of the target groups imply that three different CLTs had to be created. Even more, within each target group, three different rankings were included, associated with the three different regions. **Table 3** provides a summary of the types of health conditions examined.

[Insert Table 3]

2. Results

2.1. Descriptive statistics

In total, 69 valid and fully answered questionnaires were collected, giving a response rate of about 27%. The average respondent age was 45.4 years and the average years of work experience were of 14.2 years. **Table 4** presents sample descriptive statistics based on the respondents' characteristics.

[Insert Table 4]

2.2. Regression results

Based on a backward selection most interaction terms have been removed, due to their insignificance. Those remaining have been included in the final model specification. Furthermore, it had been tested whether alternative-specific constants (ASCs) should be included in the model. As expected, the inclusion of an ASC in this generic model gave a statistically insignificant parameter (p-value$_{ASC1}$=0.18), which was dropped from the estimation. Comparisons between the CL and MXL model were based on the values of Bayesian Information Criterion (BIC). Based on these values, the CL model outperformed the MXL specification, both in the case where only main effects were considered random (BIC$_{CL}$=1.11 and BIC$_{MXL}$=1.21) and when also interaction terms were included in the random variables list (BIC$_{CL}$=1.11 and BIC$_{MXL}$=1.12).

Table 5 illustrates the results of the conditional models. Regarding the main effects of the general model, respondents penalise the interventions targeting middle and high age groups (as compared to those targeting young age groups) as well as those interventions that require public support (willingness to subsidise others). On the other hand, they favour interventions that benefit a larger share of the population; interventions that offer substantial health benefits for those treated, treatments that target the severely-ill, and those that are proven to be cost-effective.

Concerning interaction effects, male respondents are more likely to choose interventions that target the elderly, as compared to young age groups. Conversely, male participants attribute lower weight on interventions that increase individual health benefits. Finally, health managers and directors in the pharmaceutical industry prioritise interventions that give a positive balance between benefits and costs (cost-effective).

[Insert Table 5]

Regarding the regional models, results from the fitted heteroskedastic model confirm that the estimated coefficients are not statistically significant (p-value$_{region1}$=0.37 and p-value$_{region2}$=0.62), thus the model is separable. The estimation results are similar to those of the general model, although some differences occur. Respondents from all regions favour interventions that target the severely-ill, that offer greater total and individual benefits and are cost-effective. Conversely, they penalise interventions targeting middle and high age groups as well as those that demand public support. Some differences are being noticed regarding the interaction terms. Male respondents from all three

regions put an “extra” weight on interventions targeting the elderly. Moreover, male participants from Catalonia and the Basque Country appear to favour interventions that offer substantial individual health benefits. Managers and pharmaceutical executives from Cantabria and Valencia dislike interventions that are proven to be cost-effective.

Tables 6 displays predicted probabilities for each criterion and for aggregate equity and efficiency criteria respectively, as well as the percentage differences. Of the four equity parameters estimated, the severity of disease and willingness to subsidise increase the probability of selection for the intervention in the general model by 4.5% and 1.7% respectively, as compared to the base alternative.

[Insert Table 6]

In all regions, severity is the only criterion that increases the selection probability by 4.5%, 4.4% and 6.3% for the regions of Catalonia/Basque Country, Cantabria/Valencia and Madrid respectively. Interventions targeting the elderly have a negative effect by 9%, 21% and 9.5% in the regions of Catalonia/Basque Country, Cantabria/Valencia and Madrid, respectively.

[Insert Table 7]

Turning to efficiency criteria, all three criteria exhibit great positive effects for the general model. Interventions with high individual benefits, a large number of beneficiaries and proven cost-effectiveness increase the probability of selection by 5.8%, 6% and 8% respectively. Similar outputs are obtained for the three regions, with the larger number of beneficiaries and high individual benefits increasing the chance of selection by 9% and 7% in both in Catalonia/Basque Country and Cantabria/Valencia respectively. The effect of the cost-effectiveness criterion reaches 10% in Cantabria/Valencia.

Overall, for interventions targeting young age groups, purely equitable interventions are 2.1% more likely to be chosen compared to the baseline value in the regions of Catalonia/Basque Country. On the other hand, for a purely efficient intervention this figure increases up to 12%. The same is true for interventions targeting middle age groups.

For interventions targeting older ages the equity aggregate difference in probabilities turns negative in all regions, with the baseline alternative being preferred[1], while the figures for efficiency remain positive, reaching 12.4%, 18.1% and 17% for Catalonia/Basque Country, Valencia/Cantabria and Madrid.

Looking at the ratios of aggregate predicted probability differences (**Table 7**), we conclude efficiency is more desirable than equity at a ratio of 5.6, 4.7 and 3.8 in each region for interventions targeted at young ages. For interventions targeting the elderly, the negative values obtained for the aggregate equity criteria are insignificant across the three regions.

Respondents from Catalonia and the Basque Country are indifferent (or find equally desirable) between one unit drop in efficiency and an almost three times increase in equity (given the negative equity-efficiency ratio of 2.9). These figures are similar in the regions of Cantabria/Valencia and Madrid, with efficiency/equity ratios of 1.2 and 4, respectively.

2.3. Composite league table calculations

Overall results of health interventions ranking according to their computed probability of selection are given in Appendix Table X. The calculations were based on the DCE criteria coefficients estimated in both the general and the sub-models. As discussed earlier, different calculations were required, in order to take into account the three categories of the "age of target group" criterion. Further, measurements were repeated for each region included in the study (Appendix Table X). The rankings of interventions are largely comparable, with the exception of age-specific interventions. Note that several interventions exhibit similar characteristics with respect to the equity/efficiency criteria, resulting in similar results, and, thus, rankings.

Overall, mental disorders interventions are the most highly ranked, with those targeting suicide and intentional self-harm attempts ranking first in both the country as a whole and each region examined. Neoplasia, CVD and endocrinology interventions follow, with the exception of Cantabria/Valencia, which gives higher priority to interventions addressing risk factors. Results are relatively similar when rankings for each age category are compared. Mental disorders interventions seem to be the most

[1] The base alternative has a higher predicted probability compared to an alternative whose efficiency attributes are set to their mean and all equity criteria are set to one.

highly ranked in young and middle age categories. Nevertheless, this is not the case for elderly groups, where CVDs are most highly prioritised. Endocrinology and neoplasia diseases are also important disease areas, although differences are being noticed depending on the type of illness and the intervention. Results are almost equivalent for the regions of Catalonia/Basque Country and Cantabria/Valencia. Some minor differences are being observed in the rankings for Madrid.

3. Discussion

The Spanish healthcare system with universal coverage and publicly funded under the responsibility of the Autonomous Communities was under severe pressure by the cost-containment measures enacted by the national and regional governments. Within this economic and political environment, the Spanish health stakeholders displayed a stronger preference for severity of disease, high individual benefits, a large number of beneficiaries and proven cost-effectiveness criterion for priority setting of interventions. In comparison, studies that investigated criteria of importance in the priority-setting process after the economic crisis focused on Uganda, Nepal, Brazil, Norway, Austria, China and Hungary so far (2, 5, 10). All of these studies included the DCE methodology and employed similar criteria following the same analysis with the identical aim, namely to allow for cross-country comparisons (with adaptation for each health care system) (26). In Nepal, Norway, Brazil, Austria, Hungary and Uganda a preference for efficiency over equity was observed (5, 10). In Israel, policy-makers seemed to balance weights between efficiency and equity criteria (26).

The preference for severity of disease aligns with the findings of similar studies conducted in Norway, Israel, Austria and Hungary, Brazil and Uganda (10, 26, 27). A review of popular preferences also listed the severity of illness as a criterion for health resource allocation (28).

The overall elicit preference of efficiency over equity lines up with the state of art in this subject, with Cuba being the exception case-study (10), and sustains that health stakeholders opt for some moderation in their preferences. The decision-makers' efficiency/equity preferences were also consistent across the three groups of regions.

The low weight for equity also might be related to the universal coverage of the Spanish National Health System (and therefore less relevant the preference to subsidise others) and the transition

towards the need of a more defined search for efficiency in the provision whereas in the last decades, the focus had been pointed to equity in the access. Looking at the equity criteria themselves, Spanish stakeholders display preferences prioritizing the young age population, which is in line with the WHO "Global Action Plan for the Prevention and Control of Non-communicable Diseases (2013-2020)", calling for prevention and early treatment of mental illness and other NCDs (29). Moreover, the recent health policy reforms (including reforms in mental health policy) highlighted the need for improvements in the coordination of health services within the country in order to reduce health access discrepancies among the ACs, the promotion of efficient resource allocation and the establishment of equal access to health services (7).

The highest rankings are contained for interventions targeting severe mental disorders, i.e. major depressive disorders and suicides (or suicidal attempts). Such clinical conditions are highly correlated with 70% to 90% of those individuals that commit suicide, suffering mostly from affective disorders (30, 31). These findings are consistent with the growing consensus in Spain that economic crisis led to significant increases in mental disorders and suicide rates (7.3 per 100 000 people in 2005 against 7.5 in 2013) (32). Unemployment rose from 8 percent in 2007 to 27.16 percent in 2013, representing the highest in Europe at that time (6). The prevalence of major depression increased significantly between 2006 and 2010, of which 50 percent were attributed to unemployment and inability to fulfil mortgage commitments (33).

Further improvements in the coordination of mental health plans across the country could possibly result in a more efficient system by reducing inequalities in mental health care access and financing (34). For instance, in Spain 90% of the price for antidepressant drugs is publicly funded (35). However, psychiatric care is one of the most neglected mental health areas and psychotherapy is covered only for a short-period of time. Access to psychiatric care is provided through a general practitioner's referral, with the coordination between primary and mental health varying between the ACs (36). These phenomena lead to an overuse of primary care services, the imbalance between need and provision of specialised care and a greater reliance on drug treatments, which is extremely relevant given the already high pharmaceutical expenditure. Therefore, further improvements in mental health access could address problems with unmet mental health need.

A comparison of our CLTs with those of other high-income countries, such as Norway and Austria, reveals some notable features (2, 5). Non-communicable diseases constitute the major burden of disease in all countries and are similarly ranked. However Spanish and Austrian decision-makers give the highest priority to mental health interventions, targeting conditions that affect young and middle-age populations, whilst Norwegian study participants favour interventions that target the elderly. Spanish policy-makers seem to focus on the working population in the interest of productivity and economic growth (3). Furthermore, Norwegian decision-makers seem to be the least attracted to mental health interventions. On the other hand, Spanish (and Austrian) stakeholders give the highest priority to depressive disorders, with results from Spain showing a great focus on suicides and intentional self-harm. These results possibly reflect concerns about the economic situation and its significant effect on population mental wellbeing. Between 2005 and 2013 Spain recorded a rise in suicide rates (6 to 7.3 per 100 000 people) contrasting the turn down in Norway and Austria (32).

Overall, this study confirms that there are measurable differences in policymakers' preferences among equity and efficiency criteria. DCEs indicate that using multiple criteria offers insights into priority-setting processes. However, this approach exhibits some substantial limitations. The number of criteria is finite, while the choice of relevant criteria is a challenge. In this study, we borrowed a set of generic equity and efficiency criteria from previous studies, possibly forgoing the chance for a deliberative discussion of the Spanish health system and socio-economic context, but allowing for international comparisons. The survey was addressed to policy-makers, research associates and representatives of the pharmaceutical industry, assuming that they, at least partially, would reflect the preferences of those involved in the health system but we ignored the preferences of the general and patient population. Finally, while our sample size is sufficient for estimation purposes, generalisability of results would require caution, especially in the case of regional sub-analysis.

4. Conclusion

The rise of healthcare expenditure is endangering the universal coverage and access to health services across the world. Under straight cost-containment, our study concludes health decision-makers value, in moderation, efficiency criteria (high individual benefits, a large number of

beneficiaries and proven cost-effectiveness) over equity (severity of disease), which aligns with evidence found in cross-country comparisons. Moreover, the present study shows the intervention priorities selected by the health decision makers are consistent with the socio-economic challenges brought up from the economic crisis that led to the increase of mental disorders, the rise of suicide rates and underinvestment in psychiatric care. Further longitudinal research comparing consumers and decision makers' elicit preferences and priority interventions would make decisions more transparent and relevant to the general population.

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Tables

Table 1_Definition of criteria and levels

Criteria	Level (regression variables)	Definition
EQUITY CRITERIA		
Severity of disease	Not severe (NotSev)*	Remaining life expectancy more than two years in absence of intervention, when acquiring/having disease
	Severe (Sev)	Life expectancy < 2 years
Willingness to subsidise others	Low Level *	Less than 70% of total health expenditures are financed from public funds (poverty reduction criterion)
	High level	Subsidise at more than 70%
Age of target group	Young *	0-15 years
	Middle-age	15-59 years
	Elderly	60 years and older
EFFICIENCY CRITERIA		
Individual health benefits	Small*	Less than five healthy life years on average for whole target group
	Large	More than five healthy life years
Number of potential beneficiaries	Few*	Less than 100 000 (those who could potentially benefit from intervention)
	Many	More than 100 000
Cost-effectiveness	Not cost-effective*	Cost/DALY > GDP/capita
	Cost-effective	Cost/ DALY < GDP/capita

Table 2_Characteristics of DCE respondents

Region	N	%	Average age (std. dev)	Male	Female	Experience	Public Health Managers	Research	Drug Industry	Health Policy	HTA	Others
Madrid	24	34,78	44,50	10	14	13,79	14	5	1	0	1	3
Valencia	20	28,99	43,90	10	10	14,45	7	0	0	13	0	0
Basque Country	15	21,74	47,93	11	4	13,60	8	0	2	1	3	1
Other regions	5	7,25	42,80	2	3	11,20	3	2	0	0	0	0
National level	5	7,25	51,40	4	1	20,00	5	0	0	0	0	0

Table 3_Types of conditions

Colour coded types of conditions
Risk factors
Neoplasia
CVD
Pulmonology
Endocrinology
Mental disorders

Table 4_Sample descriptive statistics

Characteristics	Frequency	Percent
Sex		
Male	37	54%
Female	32	47%
Experience		
More than 10 years	28	41%
Less than/equal to 10 years	41	59%
Job type		
Policy-maker	14	24%
Health manager	40	49%
Consultant	15	27%
Region		
Catalonia/Basque Country	18	27%
Cantabria/Valencia	22	32%
Madrid	24	41%

Table 5_Conditional logit estimation results with individual characteristics interactions

	General Model	Catalonia/Basque Model	Cantabria/Valencia Model	Madrid Model
EQUITY CRITERIA				
Severity of disease	0.650*** (0.110)	0.641*** (0.219)	0.488*** (0.166)	0.796*** (0.193)
Age of target group: Middle	-0.093 (0.111)	-0.034 (0.253)	-0.049 (0.175)	-0.110 (0.169)
Age of target group: High	-1.257*** (0.193)	-1.031*** (0.308)	-2.254*** (0.468)	-0.744*** (0.244)
Willingness to subsidise others	-0.236*** (0.090)	-0.289 (0.227)	-0.072 (0.145)	-0.297** (0.140)
EFFICIENCY CRITERIA				
Number of potential beneficiaries	0.906*** (0.097)	0.856*** (0.204)	1.121*** (0.178)	0.881*** (0.162)
Individual health benefits	1.263*** (0.170)	1.054* (0.556)	1.562*** (0.297)	1.392*** (0.180)
Cost-effectiveness	0.900*** (0.153)	0.983** (0.391)	1.289*** (0.307)	0.612*** (0.183)
INTERACTIONS				
*Age of target group: High*Male*	0.437* (0.256)	0.344 (0.363)	1.011 (0.689)	0.076 (0.362)
*Individual health benefits*Male*	-0.389** (0.191)	0.069 (0.516)	-0.649* (0.393)	-0.685*** (0.221)
Cost-effectiveness Health Manager*	0.392** (0.186)	0.499 (0.361)	-0.079 (0.406)	0.634** (0.263)
# Individuals	69	18	22	24
Observations	2210	608	734	868
LogL	-516.8	-142.2	-153.2	-205.1
Pseudo-R^2	0.325	0.324	0.398	0.318

Notes: Numbers in parenthesis are t-values. The (*), (**) (***) indicate that the estimated coefficients are significant at 10%, 5% and 1% significant level, respectively.

Table 6_Unconditional Predicted probabilities and % changes as compared to base alternative

	General Model		Catalonia/Basque Model		Cantabria/Valencia Model		Madrid Model	
	Predicted Probability [b]	%Δ compared to base	Predicted Probability	%Δ compared to base	Predicted Probability	%Δ compared to base	Predicted Probability	%Δ compared to base
Base alternative [a]	0.84		0.84		0.81		0.80	
EQUITY CRITERIA								
Severity of disease	0.88	4.5	0.88	4.5	0.84	4.38	0.86	6.34
Middle age group	0.83	-0.97	0.84	-0.36	0.80	-0.63	0.79	-1.33
High age group	0.75	-10.54	0.77	-8.66	0.64	-20.75	0.72	-9.47
Willingness to subsidise others	0.86	1.76	0.82	-2.38	0.80	-0.71	0.78	-2.81
EFFICIENCY CRITERIA								
Number of potential beneficiaries	0.89	6.01	0.92	9.02	0.88	9.08	0.86	6.92
Individual health benefits	0.89	5.83	0.90	7.24	0.87	7.65	0.85	5.71
Cost-effectiveness	0.91	7.99	0.92	8.95	0.88	9.65	0.88	9.21

a Based alternative is based on setting all attributes at their mean
b Each alternative is identical to the base with the exception of the attribute of interest that is set at one.

Table 7_Aggregate predicted probabilities, % changes and equity-efficiency trade-offs

	Interventions targeting young age groups								
	Catalonia/Basque Country			Valencia /Cantabria			Madrid		
	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio
Base alternative	0.87			0.86			0.84		
Aggregate equity alternative	0.89	2.13		0.88	2.66		0.87	3.63	
			5.58			4.68			3.76
Aggregate efficiency alternative	0.97	11.90		0.97	12.48		0.96	13.68	
	Interventions targeting middle age groups								
	Catalonia/Basque Country			**Valencia /Cantabria**			**Madrid**		
	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio
Base alternative	0.87			0.86			0.83		
Aggregate equity alternative	0.88	1.89		0.88	2.31		0.86	2.73	
			6.37			5.48			5.19
Aggregate efficiency alternative	0.97	12.04		0.97	12.68		0.95	14.19	
	Interventions targeting old age groups								
	Catalonia/Basque Country			**Valencia /Cantabria**			**Madrid**		
	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio	Agg. Prob.	% Δ	EE Ratio
Base alternative	0.84			0.81			0.81		
Aggregate equity alternative	0.8	-4.29		0.69	-14.81		0.78	-4.24	
			-2.88			-1.22			-3.94
Aggregate efficiency alternative	0.97	12.39		0.95	18.13		0.95	16.70	

Table 8 Part 1_CLT rankings for the general model

CLINICAL CONDITION	Intervention	Conditional Rank
Suicide and intentional self-harm	Education, promote individual, family, community connectedness	1
Major depressive disorder	Older antidepressant drug medication (TCA)	2
Major depressive disorder	Newer antidepressant drug medication	2
Major depressive disorder	Psychosocial treatment	2
MN of colon, rectum and anus	Surgery with/without adjuvant treatment (a)	5
MN of the female breast	Surgery (Lumpectomy, Mastectomy) with adjuvant treatment (b)	5
MN of prostate	Monitor cancer (Watchful Waiting, Active Surveillance)	5
MN of prostate	Surgery with/without adjuvant treatment (c)	5
Acute Myocardial Infarction (AMI)	Medication (aspirin, atenolol, streptokinase, tissue plasminogen activator)	5
Acute Myocardial Infarction (AMI)	Surgery (Primary angioplasty, primary stenting, percutaneous transluminal coronary angioplasty (PTCA))	5
Atherosclerosis	Medication (aspirin, atenolol, ACE inhibitors, Statins)	5
Atherosclerosis	Surgery (percutaneous transluminal coronary angioplasty - PTCA)	5
Angina pectoris (stable angina)	Angioplasty, Stenting	5
Angina pectoris (stable angina)	Surgery (Coronary artery bypass graft)	5
Diabetes mellitus type 2	Foot care (patient and provider education, foot examination, foot hygiene, appropriate footwear)	5
Diabetes mellitus type 2	Education (patient self-management)	5
Congestive Heart Failure (CHF)	Medication (ACE inhibitors, Beta-Blockers)	17
Unhealthy diet	Promote healthy eating in school	18
Physical Inactivity	Promote physical activity in schools	18
Unhealthy diet	Reduce salt intake	20
MN of colon, rectum and anus	Screening (Fecal occult blood testing (FOBT), Colonoscopy, Sigmoidoscopy)	20
MN of the female breast	Screening (self-examination, clinical breast examination, ultrasound, mammography)	20
Hypertension	Medication (ACE inhibitors, beta-blockers)	20
High blood cholesterol	Medication (Statins)	20

Table 8 Part 2_CLT rankings for the general model

Angina pectoris (stable angina)	Medication (Atenolol, ACE inhibitors, Beta-Blockers)	20
Asthma control	Medication (inhaled ipratropium bromide, rapid-acting bronchodilators, inhaled corticosteroid)	20
Chronic obstructive pulmonary disease (COPD) - Stage 1-2	Medication (inhaled ipratropium bromide, rapid-acting bronchodilators, inhaled corticosteroid)	20
Diabetes mellitus type 2	Glucose control (insulin, oral glucose-lowering agents)	20
Unhealthy diet	Provide health education in worksites	30
Congestive Heart Failure (CHF)	Surgery (Coronary artery bypass graft)	31
MN of larynx and trachea, bronchus, lung	Surgery with/without adjuvant treatment (a)	32
Chronic obstructive pulmonary disease (COPD) - Stage 3-4	Home oxygen therapy	32
Tobacco use	Raise tax on tobacco	34
Tobacco use	Enforce bans on tobacco advertising	34
Tobacco use	Enforce clean indoor air law	34
Harmful alcohol use	Raise tax on alcohol	34
Harmful alcohol use	Enforce bans on alcohol advertising	34
Unhealthy diet	Promote public awareness about diet	34
Physical Inactivity	Promote physical activity in mass media	34
Alzheimer's disease & dementias (Stage 1)	Comprehensive in-home care	34
Physical Inactivity	Offer counselling in primary care	42
Congestive Heart Failure (CHF)	Surgery (Heart transplant)	43
Cerebrovascular disease (acute treatment)	Medication (Aspirin, Heparin, rt-PA)	44
Cerebrovascular disease (prevention of recurrence)	Medication (Aspirin, dipyridamole, carotid endarterectomy)	44
Harmful alcohol use	Enforce drink-driving laws (breath-testing)	46
Alzheimer's disease & dementias (Stage 2)	Nursing home/hospital care	46
Chronic obstructive pulmonary disease (COPD) - Stage 3-4	Surgery (Lung volume reduction, lung transplant)	48

Table 9 Part 1_CLT rankings for every region

CLINICAL CONDITION	Intervention	Rank Catalonia/ Basque	Rank Cantabria/ Valencia	Rank Madrid
Suicide and intentional self-harm	Education, promote individual, family, community connectedness	1	1	1
Major depressive disorder	Older antidepressant drug medication (TCA)	2	2	2
Major depressive disorder	Newer antidepressant drug medication	2	2	2
Major depressive disorder	Psychosocial treatment	2	2	2
MN of colon, rectum and anus	Surgery with/without adjuvant treatment (a)	5	5	5
MN of the female breast	Surgery (Lumpectomy, Mastectomy) with adjuvant treatment (b)	5	5	5
MN of prostate	Monitor cancer (Watchful Waiting, Active Surveillance)	5	7	5
MN of prostate	Surgery with/without adjuvant treatment (c)	5	7	5
Acute Myocardial Infarction (AMI)	Medication (aspirin, atenolol, streptokinase, tissue plasminogen activator)	5	7	5
Acute Myocardial Infarction (AMI)	Surgery (Primary angioplasty, primary stenting, percutaneous transluminal coronary angioplasty (PTCA))	5	7	5
Atherosclerosis	Medication (aspirin, atenolol, ACE inhibitors, Statins)	5	7	5
Atherosclerosis	Surgery (percutaneous transluminal coronary angioplasty - PTCA)	5	7	5
Angina pectoris (stable angina)	Angioplasty, Stenting	5	7	5
Angina pectoris (stable angina)	Surgery (Coronary artery bypass graft)	5	7	5
Diabetes mellitus type 2	Foot care (patient and provider education, foot examination, foot hygiene, appropriate footwear)	5	7	5
Diabetes mellitus type 2	Education (patient self-management)	5	7	5
Congestive Heart Failure (CHF)	Medication (ACE inhibitors, Beta-Blockers)	17	7	17
Unhealthy diet	Reduce salt intake	18	7	18
MN of colon, rectum and anus	Screening (Fecal occult blood testing (FOBT), Colonoscopy, Sigmoidoscopy)	18	19	18
MN of the female breast	Screening (self-examination, clinical breast examination, ultrasound, mammography)	18	20	18

Table 9 Part 2_CLT rankings for every region

MN of prostate	Screening (Digital rectal exam (DRE), Prostate specific antigen test (PSA))	18	21	18
Hypertension	Medication (ACE inhibitors, beta-blockers)	18	21	18
High blood cholesterol	Medication (Statins)	18	21	18
Angina pectoris (stable angina)	Medication (Atenolol, ACE inhibitors, Beta-Blockers)	18	21	18
Asthma control	Medication (inhaled ipratropium bromide, rapid-acting bronchodilators, inhaled corticosteroid)	18	21	18
Chronic obstructive pulmonary disease (COPD) - Stage 1-2	Medication (inhaled ipratropium bromide, rapid-acting bronchodilators, inhaled corticosteroid)	18	21	18
Diabetes mellitus type 2	Glucose control (insulin, oral glucose-lowering agents)	18	21	18
Unhealthy diet	Promote healthy eating in school	28	21	28
Physical Inactivity	Promote physical activity in schools	28	21	29
Unhealthy diet	Provide health education in worksites	30	21	29
MN of larynx and trachea, bronchus, lung	Surgery with/without adjuvant treatment (a)	31	31	31
Chronic obstructive pulmonary disease (COPD) - Stage 3-4	Home oxygen therapy	31	32	32
Congestive Heart Failure (CHF)	Surgery (Coronary artery bypass graft)	33	32	32
Tobacco use	Raise tax on tobacco	34	34	34
Tobacco use	Enforce bans on tobacco advertising	34	34	35
Tobacco use	Enforce clean indoor air law	34	34	36
Harmful alcohol use	Raise tax on alcohol	34	34	37
Harmful alcohol use	Enforce bans on alcohol advertising	34	34	37
Unhealthy diet	Promote public awareness about diet	34	34	37
Physical Inactivity	Promote physical activity in mass media	34	34	37
Alzheimer's disease & dementias (Stage 1)	Comprehensive in-home care	34	34	37
Physical Inactivity	Offer counselling in primary care	42	42	37
Cerebrovascular disease (acute treatment)	Medication (Aspirin, Heparin, rt-PA)	43	43	37
Cerebrovascular disease (prevention	Medication (Aspirin, dipyridamole, carotid	43	44	44

Table 9 Part 3_CLT rankings for every region

of recurrence)	endarterectomy)			
Congestive Heart Failure (CHF)	Surgery (Heart transplant)	45	44	44
Harmful alcohol use	Enforce drink-driving laws (breath-testing)	46	46	46
Alzheimer's disease & dementias (Stage 2)	Nursing home/hospital care	46	46	46
Chronic obstructive pulmonary disease (COPD) - Stage 3-4	Surgery (Lung volume reduction, lung transplant)	48	48	48