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Summary

The management of health care systems is facing the problem of long waiting lists in many of the services offered. The use of waiting time as a device for rationing the allocation of medical care does not seem to be a fair and just criterion. The main aim of this paper is the development of a weighting system, based on the patient's differential characteristics, for prioritising access to the polysomnograph test for sufferers of apnea. To this end, a single Choice Experiment (CE) was applied to a representative sample of the population of Zaragoza (Spain) and a combined approach of CE and Citizens' Juries (CJ) to a group of selected participants. Although CE and CJ have been widely applied to different health economics issues, the joint model proposed for the development of a weighting system is, to the best of our knowledge, new and original. The results of our work suggest an enhanced model which responds to many of the criticisms raised in the relevant literature.

Keywords: Waiting lists, prioritisation, weighting system, discrete choice experiments, Citizens' Juries.

Introduction

One of the main problems in the management of public health systems is the long waiting lists in many of the services and the lack of transparency of their administration. A number of health care systems use waiting time as rationing criteria for access to external surgery, diagnostic tests or surgical interventions. Although in a public health care unit or service, it is common practice to place patients in a queue on a 'first come, first serve' basis, this does not seem to be a fair and just system as not everybody is in the same situation, with identical characteristics or needs. There are some situations in which patients are clinically prioritized in such a way that those with specific characteristics are attended to first, but the wider society is not generally aware of the criteria and the size of the waiting lists. These criteria may be arbitrary and vary from one practitioner to another, depending on the particular weighting of each individual characteristic.

Some institutions and authors have theoretically argued in favour of introducing priority scoring systems. The British Medical Association has stated that waiting time should not be the key element in judging the management of waiting lists, suggesting that patients should be given severity scores when they are put on a waiting list; these would reflect the patients' clinical priority and how quickly they should receive surgery (Fricker, 1999).

The advantages of this practice are well known; it makes the management of waiting lists transparent, the priority criteria explicit, and it favours the ordering of patients based on clinical needs, rather than according to arbitrary maximum waiting time guarantees (Edwards, 1999).

The first institutional attempt to manage waiting lists was based on a linear point system according to patients' characteristics and was used to allocate organs in the US – the

UNOS system (Pierce *et al.*, 1996). Similarly, in New Zealand, a committee of experts was established to develop standardized sets of criteria to assess the extent of benefits expected from elective surgical procedures: cataract surgery, coronary artery bypass grafting, hip and knee replacement, cholecystectomy and tympanostomy tubes for otitis media with effusion. These criteria gave priority to patients on the basis of their clinical and social characteristics (Hadorn and Holmes, 1997).

This social concern for achieving a more equitable management of waiting lists has been echoed in the specialised academic literature. One of the first studies that looked at the question of waiting lists quantified the disutility of time spent in the waiting list for non-urgent treatment (Propper, 1995). Since then, a number of techniques and approaches have been devoted to dealing with the different aspects of the waiting lists issue.

Among the economic tools used to measure individual preferences for health care, Conjoint Analysis (CA), as a group of techniques, has acquired a central role over the last decade. One of the methodologies is known as Choice Experiments (CE), it is based on the assumption that health care interventions, services or policies can be described by their characteristics (or attributes) and respective levels and that an individual's evaluation will depend on them. CE makes it possible to identify the relative importance of multiple factors and trade-offs between them and for this reason it has been used to elicit economic values (Ryan and Farrar, 2000; Ryan *et al*., 2001; Ryan and Gerard, 2003).

Waiting time has often been considered as a main attribute for eliciting community viewpoints regarding the importance of reducing it (Ryan *et al*. 2000; Burge *et al*., 2004). Discrete choice modelling has also been advocated as an instrument in the area of priority setting, specifically for establishing a ranking of 38 potential competing clinical service developments (Farrar *et al*., 2000).

In spite of the importance of these preference-based techniques, their use in the organization of waiting lists has been minimal. It is accepted that the individual patient can be described in relation to the health services they require in such a way that *certain* personal characteristics become relevant for that specific health service, whilst for other services, those individual attributes will not be taken into account.

Ratcliffe (2000) analysed the nature of public preferences in the allocation of donor liver grafts for transplantation through a social conjoint analysis. Respondents were presented with eight choice situations in which they were asked to allocate 100 donor liver grafts between two groups of 100 individuals in urgent need of a transplant. The groups of patients differed in terms of the length of time spent waiting, the life years gained following the transplant, age, personal responsibility for their illness and whether they were primary or re-transplant candidates.

Ross *et al.* (2003) applied a ranking exercise to nine cataract surgery packages in order to determine the relative importance that patients in the waiting list gave to waiting time, complication rate and surgeon grade. Rodríguez-Míguez *et al*., (2004) also applied a ranking exercise for a cataract condition and they confirmed the results from a previous study (Pinto *et al.*, 2000). In the latter, they developed a points system for a specific condition – cataracts - based on the preferences of the general population. A sample of the general population was asked to rank a number of hypothetical patients with different characteristics (waiting time, patient age, likelihood of improvement, limitation on activities and visual incapacity) in terms of the priority they thought these patients deserved. This work was replicated and extended to the prioritization of patients on waiting lists for hip and knee replacements by Espallargues *et al.* (2003).

In another empirical analysis using ranking exercises to prioritise patients with different attributes, Dolan and Tsuchiya (2005) proposed prioritisation between groups of patients based on past years (age), past health, future years without treatment and future health without treatment.

The objective of our study is to establish a scoring system for organising the waiting lists of a health service system. In order to achieve acceptance of the criteria, our use of CE is slightly different to its conventional application – we make use of Citizens' Juries (CJ). Choice Experiments (CE) and Citizens' Juries have been widely applied to health economics issues but they have never been used in a combined form or for the development of a scoring system.

Like all conventional stated preference approaches, CE has received its fair share of criticism. The main issues related to this paper are as follows:

Firstly, there are criticisms concerning problems of dealing with unfamiliar goods or services and therefore of decisions being based on 'uninformed preferences'. In a typical stated preference study, very little time is available for conveying information about complex and unfamiliar tasks. Standard interview formats, such as one-on-one in-person surveys or mail shots, may find it difficult to supply sufficient information to the respondents for them to feel confident of assessing alternative levels of the service, both in terms of its importance to them and to the wider community. Respondents are not usually able to query the information they are given, nor can they request additional information. Choices from people with a limited understanding of what it is they are being asked to organize or evaluate could be seen as a poor basis for policy-making.

Secondly, people are unlikely to have pre-existing preferences for complex or unfamiliar health services (thus violating the completeness axiom of neo-classical consumer theory); they will construct their preferences in a context-dependent manner during the course of a conventional survey.

The third point is that when making purchasing decisions, voting over political issues or when deciding whether to contribute to good causes, people have time to discuss the issue with their family and friends, to learn more about the issue by researching it and they have time to reflect on its relative importance. None of these are possible in a typical stated preference study.

Finally, Sagoff (1988) has argued that society bases decisions on environmental, moral, health and safety issues on community preferences rather than the aggregation of individual preferences. Indeed, in such areas, people may suppress their individual desires or selfish interests on behalf of the common good. This idea, elaborating on previous works, such as Marglin (1963), suggests that *homo economicus* has two sides and both are consulted when making different kinds of decisions. This was previously referenced by Baumol (1952) who first distinguished between individual and collective behaviour. This difference in behaviour would be motivated by *ethical* preferences or based on impersonal, social issues and by *subjective personal* preferences (Harsanyi, 1955). Musgrave (1959) argued that the individual was guided by political decisions made by the consumer that considered the concept of a fair society, but lead by personal needs.

In the same way, Sen (1961), argued that there is no reason why a person acting in a political context should hold the same preferences in daily life. For Harsanyi (1955), decisions on social issues should be based on ethical preferences, and in such a way that public issues should account for communitarian values.

There have been attempts to combine of both kinds of preferences (Tullock, 1967), however, this proved controversial for Sagoff (1988) who did not agree with the practice. Goodin (1986) was in favour of maintaining the distinction, alleging that in the context of taking a collective decision, individuals will only state the *ethical* preferences while omitting their own private and selfish predilections.

In spite of the theoretical literature on the divergence between private and social preferences, only a small number of studies have empirically addressed this issue. *Lázaro et al.* (2001) estimated time preferences for health and money in both private and social contexts, finding that private time preferences exceeded social time preferences. Gyrd-Hansen (2004) found that values for increases in health services seem to be affected by whether questions are framed as individual or social choices. The main conclusion of this paper was that the use of QALY values elicited from an individual perspective may not be valid in social decision making. Both studies highlight the fact that there is more than one perspective that can be used in the elicitation of preferences.

Finally, and of particular interest for our research, Sagoff (1998) argued that stated preference methods target the wrong set of preferences: they attempt to measure individual-based or consumer desires in contexts where social decisions should be made on the basis of citizens viewpoints.

In order to test for this and also to address the problems associated with traditional stated preference methods, we combined elements of a 'Citizens' Jury' with the Choice Experiment approach, after undertaking an identical survey with the general population. Citizens' Juries attempt to meaningfully involve members of the public in decisions that affect their communities. The Cambridge and Huntingdon Citizens' Jury is an example that is of great interest to our work: this experiment showed that the public is willing and able to contribute to the debate about priority setting in health care (Lenaghan *et al.*, 1996). Citizens' Juries are small groups of citizens, usually around twelve in number who meet to discuss a particular issue over two or three days (Coote and Lenaghan, 1997; Aldred and Jacobs, 2000).

The jury members, who are selected to be 'symbolically representative' of a population, hear witnesses present evidence on the issue; they question these witnesses and decide on an agreed, preferred course of action. The agreement is typically a ranking of alternative actions (for instance over strategies for reducing traffic in Edinburgh) (Kenyon *et al.,* 2001).

The central issue in our study is the Obstructive Sleep Apnea Syndrome (OSAS), also known as apnea. The syndrome is a disorder characterized by repeated, prolonged cessation of breathing during sleep for at least 10 seconds. These periods of lack of breathing are followed by sudden attempts to breathe. The attempts are accompanied by a change to a lighter state of sleep. The result is an extremely fragmented sleep that is not restful, followed by excessive daytime drowsiness. Other common consequences are morning headaches, memory loss, changes in mood and lack of concentration. In the long term, OSAS is associated with increased morbidity and mortality from cardiovascular problems (Young, Peppard *et al.*, 1997) and traffic accidents (Young, Blunstein *et al*., 1997). OSAS is considered a severe public health problem; it has been estimated that it affects up to 4% of the working male population of the United States (Young *et al.*, 1993). In Spain it is believed that it affects between 0.8% and 2% of women and between 2.2% and 6% of men (Marin *et al.*, 1997).

Polysomnography is the standard test for the diagnosis of OSAS. The patient spends a whole night in the hospital so that normal patterns of sleep can be reproduced. The Polysomnography measures a variety of parameters used for the diagnosis of OSAS and its treatment.

This study is based on the waiting list for the Polysomnography test at the *Hospital Universitario Miguel Servet* in Zaragoza (Spain). The fact that only two patients are tested per night, combined with the high number of patients, means that there is a long waiting list for access to the test.

A new and original feature of our work is the application of CE in order to develop a points system for patients on the waiting list for a diagnostic test. The first objective of this paper is the development of a weighting system, in accordance with the patient's differential characteristics, which allows the prioritisation of patients suffering from sleeping disorders to have access to a polysomnograph test at the aforementioned hospital.

The second methodological objective was to test if the data gathered from the general public is comparable to that elicited from a Citizens' Jury (CJ). If results support the CJ option, the door to a cheaper and more comprehensive method for preference decisions could be opened.

The rest of this paper is organized as follows: Part one is devoted to the methodological presentation of the combined method of CE in a context of CJ; part two deals with the presentation of the case study and the last part is dedicated to the results and conclusions.

Methodology

Despite the fact that the multinomial logit model (MNL) has been the most widely applied to the estimation of discrete choice modelling, as explained earlier, there are still several behavioural questions which cannot be resolved. We propose the application of the mixed logit model (ML) –also referred as random parameter logit, mixed multinomial, logit or hybrid logit (Hensher *et al*. 2005, Train, 2003)–. ML obviates three limitations of standard logit, by allowing for random taste variation, unrestricted substitution patterns and correlation in unobserved factors and it is open to different parameter distributions whilst incorporating certain behavioural aspects (Train, 2003), but it is not free of critics (Louviere, 2004; Louviere et al 2005; Louviere, 2006).

Departing from the utility function, individual *n* is faced with *J* alternatives; in this case, the alternatives correspond to the different patient-situations. The utility of person *n* from alternative *j* is specified as

$U_{nj} = \beta_n' x_{nj} + \varepsilon_{nj}$, (1)

where x_{nj} are the observed variables that relate to the alternative and individual, β_n, is a vector of coefficients of these variables for person *n*, and ε_{nj} is the random term that is iid (identically and independently distributed) extreme value. This specification is the same as for the standard logit except that β varies over individuals. The probability of an individual choosing one option against another will be based on that which produces the highest utility. Since we do not know the βs, the unconditional choice probability is the mixed logit probability,

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{ni}}} \right) f(\beta) d\beta \qquad (2)$$

This probability is a weighted average of the logit formula evaluated at different values of β, with weighting given by the density f(β|θ). This weighted average is the reason why the name 'mixed' has been given to the function. The parameters from a mixed logit are of two kinds: the β which enter the logit formula and a second set that describe the density of β, θ. Thus, the choice probabilities on a mixed logit do not depend on the values of β, but on functions of θ,

$$P_{ni} = \int L_{ni}(\beta) f(\beta|\theta) d\beta \qquad (3).$$

As can be observed, the *β*s are similar to the ε_{nj}, since both are random terms integrated to obtain the choice probabilities (Train, 2003). Variation in tastes related to observed attributes are captured both through specification of the explanatory variables and the mixing distribution. This model will allow us to test for heterogeneity in the responses. In our model, we assume that this heterogeneity will be reduced if respondents have the opportunity to deliberate and debate (for example during a jury, workshop or focus group). ML will allow us to test if there is a reduction in this heterogeneity due to the deliberation process or, on the contrary, the positions are maintained throughout the process.

Moreover, we compare the estimates between data sets and models but this is not directly possible as they are confused with the scale parameter. These are estimates of the original coefficients divided by the scale parameter (μ), in such a way that they indicate the effect of each observed variable relative to the variance of unobserved factors (Train, 2003). The scale parameter is equal to $\pi^2 / 6\sigma^2$ where σ^2 is the variance of the error term; but it cannot be estimated separately and only the ratio of scale parameters from different data sets can be estimated. We followed the approach proposed by Swait and Louviere (1993) and applied by Colombo et al (2005), to estimate the ratio of scale parameters between sets, rescaling one of them (multiplied by the hypothesized value of the scale parameter) and pooling both to conduct a one-dimensional grid search using different values of the scale parameter. The correct value of the scale parameter ratio is found when the log-likelihood of the pooled model is maximized. The test statistic used is:

$$LR = -2\left[LogL_{\mu 1/2} - \left(LogL_{x_1} + LogL_{x_2} \right) \right] \qquad (4)$$

where $LogL_{\mu 1|2}$ is the log-likelihood obtained from the pooled $[X_1]$ and $[\mu_{1|2} X_2]$ datasets, and $LogL_{X1}$ and $LogL_{X2}$ are the log-likelihoods corresponding to separate estimations of

X_1 and X_2. This test statistic is asymptotically χ^2 distributed with [k + 1] degrees of freedom, where k is the number of parameters estimated in the two models.

We applied a mixed logit model allowing for correlation between attributes.

Case study

As we stated in the introduction, the aim of this paper is to develop a weighting system, in accordance with patients' differential characteristics, which enables the prioritisation of individuals suffering from apnea to have access to the proper test. The methodological objectives are to investigate: i) if the selected attributes (the weighting system) obtained from the choices made by the general public coincide with those chosen by the Citizens' Jury; ii) if the Citizens' Jury's choices correspond to the average responsible citizen in the role of decision maker in terms of what is best for the community; and iii) if the Citizens' Jury format (with repeated sessions) allows for the building up of preferences during the sessions, thereby reducing heterogeneity.

The scenario was the waiting list for the polysomnograph test for patients suffering from Obstructive Sleep Apnea Syndrome; the basic criterion to access the test is simply waiting time on list, but recognition of the fact that not everybody has the same needs led to the design of a weighting system, according to patient's differential characteristics.

Focus groups were initially held at the Hospital Miguel Servet in Zaragoza in 2002. A contingent valuation survey (with 50 participants) was used to design the information materials and questionnaire wording, after several interviews with the staff at the Service of Clinical Neurophysiology took place.

The relevant characteristics or attributes identified for weighting are (besides the time on waiting list itself): the presence of other annoying symptoms (apart from snoring), occupation; and previous cardiovascular or respiratory conditions. A more detailed description of attributes and levels is as follows:

Additional Symptoms: although a common characteristic of all patients is the presence of snoring during sleeping time, there are some patients suffering from other additional symptoms. For instance, morning headaches, memory loss, changes in mood, lack of concentration or libido. Such additional symptoms can mean that the illness is more severe.

Two levels of *additional symptoms* were established: a) without additional symptoms, b) with additional symptoms.

Occupation: this attribute consists of the patient's daily life activity. Certain jobs or occupations represent different levels of risk for the patient or for third parties. For instance, a bus or taxi driver may suffer reduced reflex reactions as a consequence of the illness and this could have fatal consequences. Two levels were identified for this attribute: a) a high-risk occupation (such as a driver, handling heavy machinery, etc) and b) a non-risk occupation (any other activity).

Previous cardiovascular or *respiratory conditions*: APNEA is a respiratory illness. It is the absence of breath during sleeping time. Patients with respiratory problems, such as asthma, or those with heart problems will probably demonstrate a higher degree of illness severity. This attribute was classified using two levels: a) without previous cardiovascular or respiratory conditions and b) with previous cardiovascular or respiratory conditions.

Time on waiting list: For this, self-explanatory attribute, the levels considered were a) two months, b) five months and c) seven months.

>>>>>>>>>>>>> Table 1 about here <<<<<<<<<<<<<<<<<<<<<<<<<<<

The attributes were combined in sets of two patient-situations, where each one represented a real or hypothetical person already on the list with a combination of the above-mentioned characteristics, as shown in table 1. Respondents were asked which person should have priority access to the test, they had the option of choosing none of them (making time on the waiting list the only prioritisation determinant) if they were unable to make a choice. Thus, the three-two level attributes and the one-three level attribute (the combination of sets of two options plus the option of choosing none of them), gave a minimum orthogonal fractional factorial design main effect of eight sets. An example of the set as presented to individuals is shown in table 2.

>>>>>>>>>>>>>>>>>>>Table 2 here <<<<<<<<<<<<<<<<<<<<<<<<<<<<

The questionnaire and cards were exactly the same for all interviews, for both the general public survey and the Citizens' Juries and they lasted about 15 minutes. The general public survey was carried out by a market research company at the end of the winter of 2005 in the city of Zaragoza using face-to-face interviews at peoples' homes and other quiet locations. The sample was randomly stratified by city location. Participants were balanced in age, sex and educational level. Respondents were requested, (after completing the questionnaire) to provide a phone number if they agreed to continue participating in the project. One hundred and eighteen (118) questionnaires were completed in the 'main survey'.

A 'jury group' (spring 2005) composed of twelve citizens from the Zaragoza area was then recruited from a panel of citizens. This panel was made up of 50 individuals who had formed part of focus groups on environmental issues on other occasions.

Participants on the juries had different incomes, ages, occupations and interests. Jurors were paid 35€ for their participation. The following two-stage method was then applied:

Group members were supplied with concise information about the main aspects of the illness and the probable solutions proposed after taking the polysomnograph test. This information was presented using a standard format, structure, presentation and the type of questions used in traditional surveys and it was limited to information that could be transmitted in no more than 6 minutes. This was done with the aim of supplying the same amount and quality of information that was supplied in the general public survey. Participants were able to ask questions before making their choice; respondents completed the survey individually, instructed to only consider their own situation. Up to this point, they were given the minimum information necessary, in order to avoid emphasising any aspect concerning a social conscience –they were simply told to choose the patient that they thought should be the first to undergo the test–. These instructions *were identical* to those used in the general public survey. The final block of questions was directed at gathering data on respondents' general attitudes and their socio-economic and personal situation.

A follow up debate between group members took place where issues and problems arising from the session were discussed. Finally, members were asked to think about all the factors considered as important for prioritising patients and those which we could have obviated. There was a discussion on the importance of each of the attributes considered relevant to giving weighting to the patient-situation.

After a break, the participants were told that their role on the jury, as a part of decision-making process, was to select the plan of action (if any) that they would choose on behalf of their community. They were also told that they had the opportunity to influence the plan for prioritization of patients. They were then reminded to make their choices on the basis of what they thought would be best for the community, (that is, to express their *citizen* values).

Results

Estimates from the ML model (Hensher *et al*., 2005; Train, 2003) are shown in table 3; the first column refers to the general public, the second column contains the results from the first session of the CJs (where the question was put on the same basis as for the general public) and the third column represents the second session of the CJs (where they were asked to choose what they considered better for society). Apart from those attributes specific to the CE, other variables included are *Antecedents* –if they have a relative or someone close with this illness–; *education* –for the level of education achieved– and *sex* –a dummy with value of 1 if the individual was a man–. They could not be entered into the model on their own so they have been combined with other attributes.

The constant is an alternative specific constant, showing the effects of choosing patient A or B, rather than leaving the choice as the person who has been on the waiting list for a longer period of time.

All the models are significant with a good overall fitting (Domenich and McFadden (1975) comparing values of ρ^2 between 0.2-0.4 and values between 0.7-0.9 of the R^2. The parameters have the expected sign and most of them are significant.

<<<<<<<<<<<<<<Table 3 here >>>>>>>>>>>>>>>>>>>>>

The table shows three types of estimates for the general survey: first are the random parameters; second are the non-random parameters that include both the attributes and the covariates while the third group of estimates includes the standard deviations of the random parameters.

Two random parameters were found for the general public data: occupation of risk and time spent on the list; in other words, the general public estimates show heterogeneity in the occupation of risk and the time already spent on the list. Standard deviations of both parameters are significant to 1%. One of the advantages of this model is the ability of identifying possible sources of heterogeneity. This is accomplished by interacting the random parameters with any other attribute or variable that may be the cause of the preference heterogeneity. From our results, heterogeneity around the risk occupation may be explained by those who have had previous experience of the illness (*Antecedents*) though not necessarily in the first person, preference heterogeneity for the time period is not only found for those with antecedents but also for highly educated people and for women.

The most important factor for prioritizing patients is to have a cardio-respiratory condition, followed by having a high-risk occupation, showing symptoms and time already spent on the list. In short, the determining factor for prioritisation is to have a condition which is personally dangerous followed by a variable which may represent a danger for others.

The first session of the CJs showed high heterogeneity on the occupation of risk and the symptoms parameters, the two most important factors for this group. In this case, a cardio-respiratory condition is ranked third, although it is close to *symptoms*. No information on the possible sources of variability could be found.

The second session of the CJs reduced the heterogeneity on preferences: *symptoms* did not continue to demonstrate heterogeneity, while having a *high-risk occupation* reduced the parameter and significance to 10%. The rest of the parameter estimates are significant and once again, the ranking changes; the most important factor is the *high-risk occupation*, followed by having a *cardio-respiratory condition*, *symptoms* and *waiting time*. The debate and discussion was full and often heated, one of the strongest arguments was that an occupation of risk was something which could be changed, and in such a way that someone diagnosed with this illness could move to a 'no-danger-for-others' job.

Other important findings were that waiting time was always identified as the least important factor to prioritize patients while the most important factor was whether a condition was harmful for the patient or represented a danger for other members of society. Changes in preferences from the first session to second may be due to two factors - the effect of maturation of preferences and differences on individual versus communitarian preferences. Given the limited nature of this study we cannot separate both effects but this indicates possibilities for future research. However, we are inclined to believe that, for example, in the case of the occupation of risk, which maintained its importance despite the issues raised during the debate, the position of the jury, as responsible decision makers, was to protect the other members of society.

Table 4 shows the weighting system derived from these estimates. This system of points is derived as

$$Points = \frac{\beta_i}{\sum_i \beta_i} \qquad (5)$$

The weighting for time should be multiplied by the number of months an individual has been on the waiting list while the rest of the aspects considered should only be added if the condition is met. For example, if an individual has a high-risk occupation, shows the symptoms but does not show a cardio-respiratory condition, he/she should enter the list with 61 points, and 9 points should be added for each month that this person remains on the waiting list. This system differs from previous systems as it gives points, in a composite manner; individuals get more points for each month spent on the list and for the conditions shown.

>>>>>>>>>>>>>>>>>>>> Table 4 about here <<<<<<<<<<<<<<<<<<<<<<<<<<<

Based on the results and our previously explained arguments we would opt for the system derived from the second session of the CJs. This model incorporates the participants' learning and understanding of the implications of the illness and its consequences as well as the perceptions of what is best for their own community, rather than for themselves as affected (or non-affected) individuals.

Testing

If we compare these estimates we have to take into account the issues of the scale parameter as explained above. To allow for the comparison we had to rescale the data sets to undertake the tests proposed by Swait and Louviere (1993). We tested if the underlying models describing the processes of choice were the same (conventional survey with session 1 of CJ and conventional survey with session 2 of CJ, and among first and second session of CJs). The results, shown in table 5, revealed that the scale parameter was $\mu^{cj} / \mu^{g} = 1. 2$ the value which is the maximized log-likelihood function of the pooled data sets. The likelihood tests provided the chi-square values shown in the table; the null hypothesis of parameters equality was clearly rejected between the general survey and the CJs while between sessions of the CJs the hypothesis could not be rejected.

>>>>>>>>>>>>>>Table 5 here ><<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<

Rejection means (if the conditional model is appropriate for our data) that the cognitive process led to a different judgment, giving rise to a different underlying preference structure.

With reference to the weighting system, we can say that in line with the test on the scale parameters, the weightings were closer for the two sets of CJs than for the general survey and any of the sessions.

Conclusions

Our main objective was the development of a weighting system for prioritising patients on waiting lists and this has been comprehensively accomplished, emphasising the importance of other attributes instead of time spent on a list. Moreover, our results show the low importance individuals assign to this latter aspect, compared to the standard practices of our public health systems.

With regards to the testing, and the question of whether the use of CJs would lead to the same results as conventional survey implementation, our results were divergent and even showed underlying preference structures. Our interpretation of this divergence is that participants in juries have more time to absorb and process the information supplied, and they are also influenced by their role as a responsible member of the community when making their decisions.

In fact, the results from the repetitive CJs showed a shift in the weighting of the different attributes. CE has been shown to be a useful instrument for managing waiting lists, especially if it is applied in a context of CJs, where the task becomes closer and more familiar to the individual because of the deliberation and debate and the information can be processed and incorporated into the decision.

Likewise, preference heterogeneity decreased over the sessions. The heterogeneity of preferences is a common, well known problem in the aggregation of preferences and changes in this heterogeneity cannot be tested via a traditional format. In this exercise, we were able to test how the heterogeneity in the preferences was reduced during the second session of CJ, supporting the assumption of a common citizens' viewpoint and decision on the course of action to be taken.

The combination of CE and CJ improves the approach for determining preferences in complex exercises; it becomes an enhancing tool for applying conjoint techniques, not only for prioritising patients on waiting lists, but also in the general use of the technique itself.

With the proper use of the scale parameter (considering and including all other relevant attributes), this points system could be applied to other public health services. Further research is needed to explore this interesting possibility.

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Table 1. Attributes and levels

Attributes	**Levels**
Additional Symptoms	• Without additional symptoms • With additional symptoms
Occupation	• No risky occupation • Risky occupation
Time on waiting list	• Two months • Five months • Seven months
Previous cardiovascular or respiratory conditions	• Without previous cardiovascular or respiratory conditions • With previous cardiovascular or respiratory conditions

Table 2. Example of "patient types" given to individuals to choose.

PATIENT A **PATIENT B**

Waiting time	**2**	**5**
Additional symptoms	**YES**	**NO**
Risky occupation	**YES**	**YES**
Cardiovascular or respiratory history	**YES**	**NO**

PATIENT **A** SHOULD BE TREATED FIRST

PATIENT **B** SHOULD BE TREATED

THAT PATIENT,WHO HAS BEEN LONGER IN THE WAITING LIST, IT SHOULD BE ATTENDED FIRST, WHITOUT CONSIDERING OTHER FACTORS

Table 3. RPL: General public, First and Second Citizens' Juries.

Attributes	**General Survey**	**CJs (1st)**	**CJs (2nd)**
Random Parameters			
Risk	1.32 (2.0) [0.1-2.52]	2.93 (2.7) [0.86-5.016]	2.11 (4.9) [1.26-2.94]
Time on list	0.33 (3.2) [-0.5-0.73]	-	-
Symptoms		1.75 (2.6) [0.446-3.32]	1.20 (2.1) [0.9-2.32]
Non-random parameters			
Symptoms	0.75 (5.6) [0.49-1.017]		
Cardio Condition	1.61 (7.3) [1.18 -2.03]	1.67 (3.3) [0.67 – 2.65]	1.56 (4.3) [0.814- 2.26]
Time on list		0.70 (2.0) [0.02 - 1.38]	0.50 (3.4) [0.204-0.79]
Constant	-7.1 (-6.5)	-0.82 (-2.6)	-1.99 (-4.6)
Risk:Antecedents	0.65 (2.2)		
Risk:Education	0.01 (0.1)*		
Risk:Sex	-0.09 (-0.4)*		
Time:Antecedents	-0.15 (-2.0)		
Time:Education	0.07 (2.3)		
Time:Sex	-0.11 (-1.9)		
Standard deviations of parameter distributions			
Risk – Std. Dev	3.37 (3.6)	1.60 (4.5)	0.75 (1.8)
Time – Std. Dev.	0.95 (3.8)	-	-
Symptoms		3.87 (2.4)	0.26 (0.3)*
n	2832	240	240
Log likelihood	-494.03	-63.07	-38.63
Pseudo R^2	0.52	0.28	0.56

* non significant

Table 4. Weights

	General	CJ1	CJ2
Occupation	33	42	39
Symptoms	19	25	22
Cardio Condition	40	24	29
Time on List	8	10	9

Table 5. Testing

μ	**General Survey with CJ1**	**General Survey with CJ2**	**CJ1 with CJ2**	**Reject**	
1.2	17,84	42,29		yes	yes
1.6			6.49	no	

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