Using conjoint analysis to elicit the views of health service users: an application to the patient health card

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Abstract

Objective To demonstrate the application of conjoint analysis (CA) for eliciting the views of health service users.

Methods A CA study was conducted alongside a randomized controlled trial evaluating the introduction of a patient health card (PHC). The PHC was evaluated with respect to three other aspects of general practice: number of days between making a non-urgent appointment and seeing a doctor; waiting time in reception between the time of the appointment and seeing a doctor; and whether the patient is usually seen by the doctor of their choice. A postal questionnaire was sent to 100 individuals from a general practice in Inverurie, Scotland.

Results Seventy-five individuals returned the questionnaire, of whom 51 answered the CA section. The PHC was the least important of the attributes considered. The number of days between making a non-urgent appointment and seeing a doctor was considered to be the most important. A 1-day reduction in the number of days to appointment was four and a half times more important than having a PHC; a 1-minute reduction in waiting time in the reception area was three and a half times more important than having a PHC; and seeing a doctor of choice was over three times more important than having a PHC. Satisfaction or utility scores for different ways of providing a general practice service also indicated that priority should be given to reducing waiting time to see a doctor or reducing waiting time in reception.

Conclusions While the PHC is a significant and positive predictor of satisfaction in general practice, it is less important than the other three attributes considered. More generally, CA appears to be a potentially useful instrument for eliciting the views of health service users.

Introduction

Finite health care resources mean decisions have to be made regarding how best to allocate resources across competing health care interventions. The NHS Management Executive, with the publication of its document *Local Voices*, stimulated purchasers to take account of the wishes of local people when setting health care priorities,¹ while the government's White Paper *Promoting Better Health* called for an increased role for consumers in the provision of primary care services.² Commonly used techniques to elicit individual's preferences include opinion polls and satisfaction surveys,³⁻⁵ Quality Adjusted Life Years (QALYs) and willingness to pay (WTP). This paper considers an alternative elicitation technique known as conjoint analysis (CA). In the next section background information is provided on current methods of involving consumers in decision making and their limitations. It is argued that CA has advantages over such methods in that it allows consideration of factors beyond health outcomes. Following this, the third section explains CA, and shows how it has been used in health economics. The technique is then applied to consider patient preferences for a patient health card (PHC). The aim here is to demonstrate the potential use of the instrument. Consideration is given to issues that need to be addressed before the instrument becomes an established technique for eliciting consumer views.

Background

One of the most common methods used in health services research to elicit users views is patient satisfaction surveys.³ While such surveys provide useful information on the factors that are important to consumers in the provision of health care, they have a number of limitations.⁵ One of the main limitations is that they do not acknowledge the existence of limited resources. Other things being equal, devoting more resources to improve one aspect of a service means taking resources away from another aspect, i.e. there is a sacrifice of benefit or an opportunity cost (where opportunity cost is defined as the

benefits foregone as a result of not using resources for their next best alternative use). For example, the opportunity cost of introducing a PHC system is the benefit that would have accrued had the resources been spent on improving other aspects of the general practice. Given limited resources, and the fact that for most aspects included in a satisfaction survey individuals would prefer improvements in all of them, preferred levels of all aspects cannot be provided. In these circumstances the relevant policy questions are: what are the relative weights of the dimensions of satisfaction identified as important, how do individuals trade off these dimensions, and, given these trade-offs, what is the optimal way to provide a service?

Techniques developed in health economics to elicit user views involve the concept of opportunity cost and trading. The three main methods used have been standard gamble (SG), time trade off (TTO) and willingness to pay (WTP). Standard gamble embodies the notion of sacrifice by asking individuals to sacrifice certainty,^{6,7} TTO asks individuals to trade time⁸ and WTP asks individuals to trade money.⁹ Standard gamble and TTO have been developed within the QALY paradigm^{10,11} which assumes that only health outcomes are important. As such, satisfaction or utility has become synonymous with health outcomes. Such utility measures are inappropriate for valuing non-health outcomes and process attributes,¹² where utility is defined as broader than health outcomes. While WTP has been developed in health economics to take account of non-health outcomes and process attributes,¹³⁻¹⁵ many individuals object to this technique because of a political objection to paying for health care, and because of the relationship to ability to pay. Conjoint analysis was identified as a potential instrument that could overcome the limitations of QALYs and WTP.

Conjoint analysis

Conjoint analysis is a technique specifically designed to look at the impact of different attributes on the overall benefit obtained from a

particular good or service. It can be used to establish the relative importance of the different attributes (characteristics or features) of a service or intervention and the trade-offs individuals make between these attributes. Conjoint analysis can also provide an estimate of the overall benefit or utility (or satisfaction) of different combinations of the levels of the attributes. It was developed in mathematical psychology¹⁶ and has been widely used in market research to establish which factors influence the demand for different commodities.¹⁷ It has also been widely used in transport economics¹⁸ and environmental economics,^{19–24} and was recommended to the UK Treasury for valuing quality in the provision of public services.²⁵

Within health care, it has been used by non-economists to examine which factors are important to patients in the provision of primary health care systems;²⁶ to establish consumer preferences for rural primary health care facilities;²⁷ to identify which factors are important to consumers in choosing a hospital²⁸ and to establish consumer preferences for dental services.^{29,30}

Use of the technique by health economists has increased during the 1990s (alongside the debate about the importance of non-health outcomes and process attributes *vis-à-vis* health outcomes). It has been used in a wide variety of contexts, including: looking at optimal service provision; estimating utility scores for specific studies; estimating WTP indirectly; within the context of randomized-controlled trials; looking at patient preferences in the doctor-patient relationship; and looking at prioritizing across clinical service developments. For example, Ryan and Farrar³¹ examined the trade-offs that individuals make between the location of a clinic and waiting time with regard to the provision of orthodontic services. The attributes of importance included waiting time, location of first appointment and location of second appointment. This study presented results on the relative importance of the attributes, the trade-offs individuals make between these attributes (i.e. how many extra days they were willing to wait for their preferred location) and total utility

scores (or benefit or satisfaction) for different ways of providing orthodontic services. Ryan¹⁴ used CA to look at the value of assisted reproductive techniques and demonstrated the importance of health outcomes, non-health outcomes and process attributes, as well as the trade-offs individuals are willing to make between these attributes. It was also demonstrated how CA could be used to estimate WTP indirectly. Ryan and Hughes³² used CA within the context of a randomized controlled trial to identify patient preferences for surgical vs. medical management of miscarriage. This study demonstrated how the technique could be used to look at the relative importance of attributes, which have been identified as different in two arms of a trial. Other similar studies, looking at patient preferences for service provision, include: Bryan *et al.*³³ who used CA to establish preferences for Magnetic Resonance Imaging (MRI) in the investigation of knee injuries; van der Pol and Cairns³⁴ who used CA to investigate patient preferences for blood transfusion support; and Vick and Scott³⁵ who used CA to assess patient preferences in the doctor-patient relationship. In a study by Farrar *et al.*³⁶ it is shown how CA can be used to elicit consultant views for alternative clinical service developments. In this study CA was used to estimate cost per unit of benefit ratios for competing clinical service developments.

There are five main stages in the design and analysis of CA studies: identifying the attributes to include in the study; assigning levels to these attributes; presenting scenarios to individuals which involve different levels of the attributes; obtaining preferences for these scenarios; and analysing the responses. These stages are discussed below with reference to eliciting the views of health service users for a patient health card.

Application: Eliciting health service users views on the Patient Health Card

Background to study

The CA study formed part of a randomized controlled trial which was carried out in Inverurie, Scotland, to look at the benefits of

introducing a PHC in general practice.³⁷ The aim of the trial was to test whether the availability of comprehensive and up-to-date information (in the form of increased access to information) on patient held electronic records would bring benefits to patients and enable health professionals to provide a more efficient service. Half of all patients at Inverurie Health Centre were issued with credit card sized optical cards holding their complete medical records. The remainder continued without a PHC. At each health care location where it was used, the card interfaced to the local computer system. This enabled health professionals to exchange information via the medium of the card. The patient could view the information on the card at any time using a stand-alone patient access system, one of which was located in the waiting area at Inverurie Health Centre. The type of information that was readily available on the PHC included medical details of the patient, information on drugs prescribed and previous medical history. In addition, the card could be used to access general medical information on, for example, stopping smoking or information about certain conditions.

The trial was administered by a multidisciplinary research team comprising clinicians, social scientists and health economists. The methodology and results of the clinical evaluation and patient satisfaction component are reported elsewhere.³⁷ The focus here is on using CA to establish the benefits to patients from the provision of a PHC in general practice. More specifically, the CA part of the study aimed to look at the value of information from the PHC vis-à-vis other aspects of general practice.

Sample and setting

The sample of 100 adults aged 16 years and over (50 cardholders and 50 non-cardholders) were selected quasi-randomly from the evaluation database (which contained 1842 patients registered with Inverurie Health Centre (IHC) half of whom had been randomized to receive a PHC, with the remaining half acting as control). This was done by determining a sampling interval (n),

picking a starting point at random and then selecting every n th name for inclusion. Randomized patients were stratified by age, sex, household size and three tracer conditions: asthma, diabetes and hypertension. Each questionnaire had a unique identifying number (the patient's Community Health Index number) so that non-respondents could be followed up. A prepaid addressed envelope was enclosed with each questionnaire together with a letter explaining who was conducting the survey, why the survey was being carried out and how the addressee had been selected (i.e. at random). As well as the CA questions, the questionnaire also contained the SF-36 health survey,³⁸ the Multidimensional Health Locus of Control (MHLC) scale,³⁹ a measure of patient satisfaction with general practice⁴⁰ and PHC-specific questions. Two weeks after the original posting a reminder letter was sent to those who had not responded with another copy of the questionnaire and another prepaid envelope. A further reminder letter was sent 2 weeks later to the remaining non-respondents.

Conjoint analysis questionnaire

The first stage in the design of a CA study is to choose the attributes. Since the importance of a PHC was being considered in this study, having a PHC was one of the attributes. As described above, the opportunity cost of introducing a PHC is the provision or expansion of any other attribute of general practice that could have been undertaken instead of a PHC. Those attributes that are of importance to patients in the choice of a general practice were established in three ways: the literature on patient preferences for attributes of a general practice was reviewed; results from a survey looking at patient satisfaction with the Inverurie health centre were assessed; and the general practitioners (GPs) at Inverurie were approached and asked what they considered to be the main concerns of their patients with respect to the attributes of the health centre, and which could actually be changed by policy. The attributes chosen are shown in Table 1.

Table 1 Attributes and levels in the conjoint analysis study

Attributes	Levels
Waiting time between making a non-urgent appointment and seeing a doctor	1 day, 3 days
How long a patient would usually expect to wait in reception between the time of the appointment and seeing a doctor	5 min, 15 min, 25 min
Whether the patient is usually seen by the doctor of choice or by any one of the doctors in the practice	0 = any one of the doctors 1 = doctor of choice
Whether the practice gives the patient a health card or not	0 = no health card offered, 1 = health card offered

Having chosen the attributes, levels must then be assigned to them. These should be realistic, plausible and capable of being traded. Levels for the chosen attributes were also decided after talking to GPs at the Inverurie practice and are shown in Table 1.

The next stage in the design of a CA study is to decide which scenarios to present to individuals. The attributes and levels in Table 1 gave rise to 24 possible scenarios ($3^1 \times 2^3$). Research from the transport literature has shown that, on average, individuals can deal with 16 scenarios at the most before fatigue and boredom set in.⁴¹ A number of methods exist to reduce the number of scenarios to a manageable level. These include the use of fractional factorial designs, removal of dominant or dominated options and the use of block designs.⁴¹ In this study a fractional factorial design was used. A component of the statistical package SPSS (Orthoplan) was used to reduce the possible number of scenarios to a manageable level whilst still allowing preferences to be inferred for all combinations of levels and attributes.⁴² The use of Orthoplan results in an orthogonal main effects design, thus ensuring the absence of multi-collinearity between attributes. Using this design, the 24 possible scenarios were reduced to eight (Table 2).

Having established the scenarios, the next stage is to elicit preferences for these scenarios. Ranking, rating or discrete choice exercises may be used to elicit patient preferences for the various scenarios. Ranking exercises involve presenting individuals with the scenarios that have emerged from the statistical design in stage 3 of the study and asking respondents to rank

them in terms of all their attributes from least preferred to most preferred. In rating exercises individuals are presented with the scenarios that have emerged from the statistical design in stage 3 of the study and asked to rate them individually on a numerical or semantic scale. Using the discrete choice approach individuals are presented with a series of 'A or B' style choices and, for each, are asked to indicate which they prefer. The discrete choice approach is generally considered to be superior by economists because it is firmly rooted in random utility theory (RUT) and reflects the type of decisions individuals make every day. However, the development of a new technique requires that all methods of collecting data be explored. It is also possible to analyse data collected from ranking and rating exercises within the framework of RUT.²⁴ Further, the relative ease of discrete choice questions, vis-à-vis ranking and rating exercises, is ultimately an empirical question, which has not been addressed. Given these factors, it was decided to use the rating approach. Individuals were presented with each of the eight scenarios from the Orthoplan design and asked to state their level of preference for each scenario on a scale of one to eight, where one indicated 'dislike very much', and eight indicated 'like very much'.

Having collected information on individual preferences, the next stage is to analyse responses. To determine the relative importance to respondents of different attributes, the trade-offs that individuals make between these attributes, and overall benefit taking into account these trade-offs, a relationship between the attributes' utility

Table 2 General practice descriptions used in the conjoint analysis study

Description	Number of days to appointment	Waiting time (min)	Which doctor you see	PHC
Practice 1	1	5	May be any doctor	No
Practice 2	3	25	May be any doctor	Yes
Practice 3	3	15	Doctor of your choice	No
Practice 4	1	25	Doctor of your choice	No
Practice 5	3	5	Doctor of your choice	Yes
Practice 6	3	5	May be any doctor	No
Practice 7	1	5	Doctor of your choice	Yes
Practice 8	1	15	May be any doctor	Yes

and the rated responses must be specified. Regression techniques can then be used to estimate the utility function. The simplest and most commonly used model is the linear additive model, which assumes that the overall utility derived from any combination of attributes of a given good or service is given by the sum of the separate part-worths of the attributes. Research has shown that alternative models seldom result in a significantly better fit than the linear additive model.⁴³ The linear additive model is specified as:

$$U = \beta_0 + \beta_1 \text{Days} + \beta_2 \text{Wait} + \beta_3 \text{Doctor} + \beta_4 \text{Healthcard} + \varepsilon \quad (1)$$

where

- (1) U_i = the utility or preference score for a general practice with a given level of each attribute,
- (2) Days = number of days the patient has to wait between making a non-urgent appointment and seeing a doctor,
- (3) Wait = how long a patient would expect to wait in reception between the time of appointment and seeing a doctor,
- (4) Doctor = whether the patient is usually seen by the doctor of their choice or by any one of the doctors in their practice (0 = any one of the doctors in the practice, 1 = doctor of their choice)
- (5) Health card = whether or not the practice gives the patient a PHC (0 = no, 1 = yes) and,

- (6) ε = the unobservable error term for the model.

The parameters β_0 to β_4 (part-worths) are estimated from the regression analysis. They can be used to establish a number of things. First, whether or not the coefficient is statistically significant will indicate whether that attribute is considered to be important by respondents when choosing a general practice. Second, if significant, the size of the coefficient indicates the size of any effect that that attribute has on overall utility – the larger the coefficient, the greater the impact. Third, the ratio of the coefficients shows how much of one attribute an individual would be willing to give up to get more of another attribute. Finally, utility scores can be estimated for different combinations of attributes by inserting the appropriate levels into Eqn (1).

For policy purposes it may be useful to know how preferences vary across individuals. For example, the importance a respondent attaches to the number of days they have to wait for a non-urgent appointment may be influenced by their health status. To allow for variation in preferences across society, interaction terms were created between: (1) health status (measured using SF-36) and 'Days'; (2) a deprivation score and 'Wait'; and (3) whether or not the respondent had a PHC and 'Health Card'. The first of these was included to allow for the possibility that individuals with poorer health may value more highly having an appointment sooner. Responses from this were re-coded into

two groups, those who answered 'excellent and very good' were re-coded as 1 and those who responded 'good and fair' were re-coded as 2.

The interaction term between deprivation and 'Wait' was included to allow for the possibility that those on a higher income may have a higher valuation of time. The overall deprivation index was created from three variables: accommodation status; number of cars owned; and the Carstairs Index (as derived from information collected in the questionnaire on postcodes).⁴⁴ Three subgroups were created: group 1 were defined as 'affluent'; group 2 were defined as 'moderately affluent' and group 3 were defined as 'less affluent'.

The interaction term between whether or not the respondent had a health card and 'Health card' was included to allow for the possibility that individuals with a health card may value it more highly.

Allowing for these interaction terms, Eqn (1) was re-estimated in the form:

$$U_i = \beta_0 + \beta_1 \text{Doctor} + \beta_2 \text{Dep1 Wait} + \beta_3 \text{Dep 2 Wait} + \beta_4 \text{Dep 3 Wait} + \beta_5 \text{SF1 days} + \beta_6 \text{SF2 days} + \beta_7 \text{Hcyeshc} + \beta_8 \text{Hcnohc} + \varepsilon \quad (2)$$

where

- (1) U_i = the utility or preference score for a general practice with a given level of each attribute,
- (2) Doctor = whether the patient is usually seen by the doctor of their choice or by any one of the doctors in their practice,
- (3) Dep1Wait = Deprivation group 1 * waiting time,
- (4) Dep2Wait = Deprivation group 2 * waiting time,
- (5) Dep3Wait = Deprivation group 3 * waiting time,
- (6) SF1 days = SF-36 group 1 * days wait to appointment,
- (7) SF2 days = SF-36 group 2 * days wait to appointment,
- (8) Hcyeshc = PHC = 1 * Health card,
- (9) Hcnohc = PHC = 0 * Health card,

(10) ε = the unobservable error term for the model and

(11) $\beta_0 - \beta_8$ = the coefficients of the model to be estimated and can be interpreted in the same ways as above.

Ordered probit was used to estimate Eqns (1) and (2).⁴⁵ This technique is preferred to Ordinary Least Squares (OLS) because of the ordinal nature of the dependent variable, i.e. on a one to eight scale indicating utility or preference for the practice. OLS assumes that ratings are cardinal utility indices, i.e. each interval on the rating scale implies the same utility difference. Further, since rating scales are bounded from both below and above, OLS will yield asymmetrically truncated residuals and biased regression coefficients. The coefficients of the ordered probit analysis were adjusted so that they could be interpreted in the same way as OLS coefficients, and also on an interval scale.⁴⁵ It is these adjusted coefficients that are used in the interpretation of the results.

The results from the regression analysis can be used to test the internal validity of CA, i.e. the extent to which results are consistent with economic theory, or, more generally, *a priori* expectations. Given that lower levels of 'Days' and 'Wait' are to be preferred, we would expect these attributes to have a negative sign in the regression equation. Further, assuming that higher socio-economic groups have a higher marginal valuation of time, we would expect that the coefficient on 'Wait', segmented by deprivation group, to be highest for deprivation group 1 (the most affluent group) and lowest for deprivation group 3 (the least affluent).

This study also included tests of internal consistency. It can be assumed that, all other things being equal, respondents prefer shorter waiting times in reception and fewer days wait before their appointment. No assumptions were made about preferences for a PHC or whether patients prefer to see a doctor of their choice. Given these assumptions, the Orthoplan design resulted in a number of scenarios which, on any rational decision making process, should be

preferred to others, and therefore obtain a higher (or at least indifferent) rating score than others. That practices 1, 7 and 8 should be preferred to practices 6, 5 and 2, respectively, was used to test the internal consistency of the questionnaire.

Results

Sixty-seven respondents returned a questionnaire, of whom 51 completed the CA section. The results are shown in Table 3. Non-response analysis and details of the respondents are reported elsewhere.³⁷

All attributes are significant at the 1% level, suggesting that they are all important in the provision of a general practice. 'Days' and 'Wait' both have a negative sign, suggesting that the lower these attributes the higher the preference score. This is what was expected and provides evidence of theoretical validity. The positive signs on doctor of choice and health card indicate that the presence of these attributes in their positive form (i.e. yes) results in a higher preference score.

The relative importance of the attributes included in the CA study can be ascertained by comparing the size of the regression coefficients. Figure 1 shows these in a histogram. The most important attribute is waiting time between making a non-urgent appointment and seeing a doctor. The next most important is how long a patient would usually expect to wait in reception

between the time of the appointment and seeing a doctor. This is followed by having the doctor of choice, while having a PHC is the least important of the attributes. The estimated coefficients represent the marginal utilities of each attribute. In other words, for any unit increase or decrease in any of these attributes the coefficients represent the unit change in the utility score arising from this. For example, an additional minute wait in reception will result in a decrease in the overall utility score of 0.220. For every additional day waiting to see a doctor utility will fall by 0.291. Being able to see the doctor of choice will increase utility by 0.172 and having a PHC will increase utility by 0.063.

Following on from this, it is possible to estimate how much more important one attribute is over another. This is indicated by the ratio of the coefficients for the different attributes. For example (see Table 3), a 1-day reduction in waiting time is over four and a half times more important than having a PHC (0.291/0.063); having the doctor of choice is over three times as important as having a PHC (0.172/0.063); and a 1-minute reduction in waiting time is three and a half times more important than having a PHC (0.220/0.063).

The ratio of the coefficients also shows how much of one attribute an individual would be willing to give up to get more of another attribute. For example, in terms of the value of 'Doctor', the results show that an individual would be prepared to wait more than an extra

Table 3 Results from the ordered probit regression model for the basic model (without segmentation)

Attributes	Coefficient	Adjusted coefficient #	P-value*	Standard deviation	95% CI**
Constant	3.300	3.300	0.001	n/a	(2.758, 3.582)
Days	-0.689	-0.291	0.001	1.00	(-0.403, -0.179)
Wait	-0.063	-0.220	0.001	8.28	(-0.233, -0.207)
Doctor of choice (0 = no, 1 = yes)	0.816	0.172	0.001	0.50	(-0.045, 0.389)
Health card (0 = no, 1 = yes)	0.300	0.063	0.006	0.50	(-0.152, 0.278)

n = 401; Standard deviation of dependent variable = 2.37; Log-likelihood: -575.55; Correct predictions = 61%; Chi-squared: 209.60 (0.0000); McFadden R² 0.15. # To enable ordered probit regression coefficients to be interpreted in the same way as OLS coefficients the ordered probit coefficient must be adjusted by: $\beta_i^* = \beta_i (x_i/x_y)$, where β_i^* is the adjusted coefficient, β_i is the regression coefficient of the equation, x_i is the standard deviation of the independent variable, i and x_y is the standard deviation of the dependent variable on its underlying scale

**P* < 0.01 (significant) and ** CI (confidence interval) estimated using the adjusted coefficient

Figure 1 Relative importance of attributes in choice of general practice.

half a day to see the doctor of their choice ($0.172/0.291 = 0.59$).

Total utility scores for different combinations of attributes can be calculated by inserting different combinations of levels of attributes into Eqn (1). These total satisfaction scores for each combination of attributes can then be ranked in order of preference, with a higher score indicating a higher preference. In Table 4, Eqn (1) has been used to estimate utility scores for each of the eight scenarios presented in the questionnaire. Such scores may, however, be estimated for all possible combinations of the levels of the four attributes identified as important. The most favoured general practice, i.e. the one that was ranked first, would be a practice that had a 1-day wait for an appointment, a 5-minute wait in reception, always the doctor of choice and one that offered a PHC. The least preferred practice, Practice 2, has a health card, but is poor with regard to all the other attributes

which have been shown to be more important than having a health card.

Table 5 shows the results from the ordered probit regression model for the segmented model. A number of interesting points emerge here. First, the health card is only important to those individuals who actually have a health card, and therefore have experience of the benefits of such a card. Individuals with no experience of the card were not considering it when valuing the different practices. The coefficients on the 'Wait' attribute indicate that respondents in the deprivation group 'affluent', had a higher marginal valuation of time. This may reflect a higher opportunity cost of time and provides further evidence of the theoretical validity of the technique.

Evidence of internal validity was also provided, with 'Days' and 'Wait' having the expected signs, and the coefficient on 'Wait' segmented by deprivation score indicating that higher socio-

Table 4 Satisfaction (utility) scores for the eight general practices presented in the conjoint analysis questionnaire

Description	'Days'	'Wait'	'Doctor'	'Healthcard'	Satisfaction (Utility) score ¹	Ranking
Practice 1	1	5	No (0)	Yes (1)	1.769	2 nd
Practice 2	3	25	No (0)	Yes (1)	-3.15	8 th
Practice 3	3	15	Yes (1)	No (0)	-0.841	6 th
Practice 4	1	25	Yes (1)	No (0)	-2.459	7 th
Practice 5	3	5	Yes (1)	Yes (1)	1.422	3 rd
Practice 6	3	5	No (0)	No (0)	1.187	4 th
Practice 7	1	5	Yes (1)	Yes (1)	2.004	1 st
Practice 8	1	15	No (0)	Yes (1)	-0.368	5 th

¹ Utility score = $3.30 - 0.291 \text{ days} - 0.220 \text{ Wait} + 0.172 \text{ Doctor} + 0.063 \text{ Healthcard}$

Table 5 Results from the ordered probit regression model for the segmented model

Attributes	Coefficient	Adjusted coefficient#	P-value*	Standard deviation	95% CI**
Constant	3.382	3.382	0.001	n/a	(2.897, 3.866)
Doctor of choice (0 = no, 1 = yes)	0.870	0.184	0.001	0.500	(-0.059, 0.427)
Days					
Health status group 1	-0.739	-0.386	0.001	1.239	(-0.252, -0.520)
Health status group 2	-0.731	-0.374	0.001	1.213	(-0.237, -0.511)
Wait					
Deprivation group 1	-0.0708	-0.265	0.001	8.860	(-0.249, -0.281)
Deprivation group 2	-0.0500	-0.162	0.001	7.679	(-0.143, -0.181)
Deprivation group 3	-0.089	-0.148	0.001	3.953	(-0.111, -0.185)
Health card (0 = no, 1 = yes)					
Has a PHC	0.470	0.090	0.002	0.455	(-0.208, 0.388)
Does not have a PHC	0.110	0.005	0.469	0.408	(-0.294, 0.304)

$n = 329$; Standard deviation of dependent variable = 2.37; Log-likelihood: -575.55; Correct predictions = 61%; Chi-squared: 209.60 (0.0000); McFadden R^2 0.15; # To enable ordered probit regression coefficients to be interpreted in the same way as OLS coefficients the ordered probit coefficient must be adjusted by: $\beta_i^* = \beta_i (x_i/\alpha_y)$, where β^* is the adjusted coefficient, β_i is the regression coefficient of the equation, x_i is the standard deviation of the independent variable, i and α_y is the standard deviation of the dependent variable on its underlying scale.

* $P < 0.01$ (significant) and **CI (confidence interval) estimated using the adjusted coefficient.

Table 6 Internal consistency

Test	Practice description*	Number of consistent responses (%)
1	1 & 6	39 (80%)
2	7 & 5	39 (80%)
3	8 & 2	47 (96%)

*see Table 2 for description of practices

economic groups had a higher marginal valuation of time. Table 6 presents the results from the tests of internal consistency. Generally, a high level of consistency, between 80 and 96%, was achieved. The higher level of consistency for test three may be explained by the fact that in this test both 'Days' and 'Wait' varied, compared with the other tests where only 'Days' varied.

Discussion and conclusions

The main aim of this study was to demonstrate the potential application of CA to elicit the views of health service users. Given this, we recognize that the results of the study are unlikely to be generalizable. However, the intention of this paper is to show the potential use

of CA at the level of policy in terms of estimating the relative importance of different attributes, the trade-offs individuals make between these attributes, and the estimation of benefit, utility or satisfaction scores for different methods of providing a given service. The utilities estimated in this study differ from those estimated in the QALY paradigm in that they are for non-health outcomes and process attributes, and are study specific. Within this context they provide useful information to policy makers concerned with the provision of general practice services. More specifically, the results suggest that, given limited resources, the introduction of a patient health card system should not be seen as a priority. We found that consumers would prefer resources to go towards reduced time between making an appointment and seeing a doctor, followed by reduced waiting time at the practice, and the facilitation of seeing the doctor of their choice. It was also shown how it is possible to estimate different models for subgroups, allowing for different trade-offs.

The ranking data can be used to inform purchasers and providers on how to change a service. Satisfaction or utility scores can be estimated for all possible combinations of the

four attributes in the study. If more resources become available for a general practice, the ranking data can be used to support a case for giving priority to a particular aspect of the service (here, 'Days'). If purchasers or providers wish to improve a service but have no additional resources with which to do this, they can use the results to redistribute resources within the service. Either way they should attempt to move as far up the table as the available resources allow.

This study was concerned with the importance of the PHC vis-à-vis other aspects of general practice. However, a future study could use CA to look at the importance of the various attributes of a PHC, since some features of the card may be more highly valued by patients. For example, PHC attributes could be divided into factors such as patient access to their own health record while in the reception area and patient ability to query the system for general health information.

Involvement in the study raised a number of issues that the reader should be aware of if seeking to design or interpret CA studies. A crucial factor in the analysis of CA data sets is that multiple observations are obtained from each individual. For example, in this study each individual provided eight observations. Whilst having multiple observations per person may be seen as an advantage of the CA technique (since it means that relatively large data sets can be obtained at a relatively low cost) an inherent problem is that the observations provided may not be independent. However, use of the ordered probit model assumes that the error term in the model is independent across observations. If individuals who are unreliable in stating their preferences for one option are also unreliable for all the options presented to them, then the assumption of random errors has to be questioned. 'Non-randomness' in the error term will result in an underestimation of the standard errors of the model and may then lead to the conclusion that some coefficients are significant when in fact they are not. Within the discrete choice CA literature, random effects probit models are used to take account of multiple observations from individuals.⁴⁶ Future research

using the rating scale approach should explore the availability of econometric software for taking account of multiple observations from individuals.

The finding that individuals who actually had a PHC valued them more highly is interesting and raises questions regarding the provision of information when eliciting preferences. In this study individuals were involved in a randomized controlled trial and had been informed about the characteristics of the PHC when they were asked to take part. Given this, it was assumed that individuals were informed about what it meant to have a PHC, and no additional information was provided in the questionnaire. However, actually having the card may be different from being told about it, at least in as much as the holder of the card has more information about its value.

This finding raises more general issues in health service research about whether to elicit values from users or the community more generally. In this study the values of users were considered within the context of a randomized controlled trial. Elit *et al.*⁴⁷ have argued that, within the context of a publicly provided health care system, it is the views of the community that are relevant. A problem with the community approach is that the community is unlikely to have a good knowledge of health care interventions. The results of a CA study critically depend on the way in which subjects are informed about the hypothetical choices they are asked to make. When community preferences are being elicited it may be more important to use interviews, interactive computer software and visual aids. Again, this is ultimately an empirical question. Literature on patient decision-making may be helpful here in offering advice on ways of presenting information to the general community.⁴⁷

Conjoint analysis is potentially a very useful tool for eliciting patient preferences in health care. However, methodological work is required before CA becomes an established instrument.⁴⁸ This study found high levels of internal consistency and theoretical validity. These results are consistent with findings from other studies.^{31-35,49} Further issues that need to be addressed include

testing the reliability, convergent validity and external validity of the technique.¹⁴ Stated preference techniques have long been criticized for the hypothetical nature of the questions posed, and doubts have been expressed as to whether individuals behave as stated in such surveys.⁹ Although a limited amount of work has established the reliability and validity of CA within the areas of market research and transport economics,¹⁴ it is not clear how applicable this work is to health care and further research is required in this area. In this paper the rating approach was chosen over the discrete choice approach to elicit preferences. Future work should address the convergent validity of these techniques (i.e. the extent to which the results are similar), as well as the strengths and weaknesses of the different approaches.

In conclusion, CA was shown to be a potentially useful instrument for eliciting the views of health service users. However, further methodological work is required before the instrument becomes an established tool.

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