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Patient preferences for the pharmacological treatment of osteoarthritis: a feasibility study using adaptive choice-based conjoint analysis (ACBCA)

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Abstract

Rationale, aims and objectives: Patient preferences, increasingly solicited as part of person-centered healthcare approaches, are an important part of optimizing the pharmacological treatment of osteoarthritis (OA). Recent choice experiments have explored this issue using two types of conjoint analysis: choice-based conjoint analysis (CBCA) and adaptive conjoint analysis (ACA). The aim of this study was to examine the feasibility of using adaptive choice-based conjoint analysis (ACBCA) methods to determine patient preferences for pharmacological treatment of OA. The specific outcomes were patient evaluations of a) 8 attributes in an ACBCA task, b) the computer skills required to complete the task and c) the perceived utility of the results.

Method: Participants were drawn from members of a Research Users' Group (RUG) who had been diagnosed with OA. Participants took part in 2 feasibility studies. In the first feasibility study, 4 RUG members critically examined the implementation of a computerized ACBCA task. In the second feasibility study, 11 RUG members completed an ACBCA task on medication preferences for osteoarthritis. The ACBCA task was evaluated by a set of self-completed questions and through semi-structured interviews.

Results: The first feasibility study helped to shape the design and contents of the ACBCA task. In the second feasibility study, no participants reported the ACBCA task to be hard to read or understand. Most participants agreed that the task adjusted appropriately as the session proceeded and that it helped them in making decisions about preferences. Older patients and those with little computer experience appeared to find no substantial challenges in using this interactive computer-based technique.

Conclusions: These studies indicate that, with the involvement of patients, face and content validity of an ACBCA task can be achieved through a developmental process taking account of participants' requirements. We advance our study as an important contribution to the person-centered healthcare literature.

Keywords

Adaptive choice-based conjoint analysis, osteoarthritis, patient preferences, person-centered healthcare, pharmaceutical treatment

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Introduction

Conjoint analysis (CA) is a form of discrete choice analysis developed by the marketing industry to elicit consumer preferences for products or services [1] and encompasses a range of techniques to determine the relative importance of the attributes underlying consumer preferences. Recently, choice experiments have been used in healthcare settings [2,3]. In 2000, however, Ryan and Farrer highlighted issues of reliability and validity when using CA in health services research [2]. In the last ten years, a number of studies have used CA to explore patient preferences, an important consideration in the person-centered approach to therapy, in the pharmaceutical treatment of osteoarthritis (OA) [4-9].

CA assumes that patient preference is determined by a range of attributes and that each attribute has a number of levels. Tablet choice, for example, may be based on 3 attributes: colour, size and frequency of administration. Taking frequency as an example attribute, possible levels could be once a day, more than once a day, only when needed. Two features of CA are useful in establishing patients' treatment preferences. First, CA determines the relative importance of the presented attributes and levels

for each individual. Second, CA shows what attributes patients are willing to trade off; for example, they may prefer larger tablets because they do not need to take them so frequently.

OA is a common long-term condition of stiff painful joints with a variable course of recurrent or persistent pain, for which a range of medications may be considered. In studying patient preferences in the pharmaceutical treatment of OA [4-9], the attributes included need to encompass treatment characteristics, benefits, complications and (in some healthcare systems) costs. However, the greater the number of attributes, the greater the complexity of the CA task. Traditional methods of CA, which ask patients to rate or rank particular attributes, have been expanded to include adaptive techniques, which reduce the complexity of the task by adapting questions according to the initial answers given by the individual patient. This can allow a larger number of attributes to be incorporated. In a study of OA, for example, adaptive conjoint analysis (ACA) was used to examine medication preferences and was able to accommodate up to 7 attributes [4-6]. The researchers concluded, however, that inclusion of more attributes - such as renal toxicity associated with non-steroidal anti-inflammatory drugs (NSAIDs) - would reduce the validity of the task.

More recently, choice-based methods (rather than techniques based on rating or ranking) have been developed to provide more flexibility. In particular, the adaptive choice-based conjoint analysis (ACBCA) technique contains elements from 2 earlier forms of CA - ACA (as described above) and choice-based conjoint analysis (CBCA) [10] - and combines both adaptation of each scenario based on a respondent's earlier choices (from ACA) and the use of choice rather than ranking of scenarios (from CBCA). This combination potentially allows more attributes to be considered [11]; as noted above, this is a key consideration in relation to the pharmaceutical treatment of OA.

As the use of ACBCA in the study of patient medication preferences has not yet been reported, the aim of this study was to examine its feasibility in patients with OA, most of whom will be in the older age strata of the population. The specific outcomes were patient evaluations of: a) 8 attributes in a choice task; b) the computer skills required to complete the task and c) the perceived utility of the results.

Materials and methods

First feasibility study

Background

This phase involved presenting an ACBCA task to members of a research users' group (RUG) in a research centre who have OA. The principle of involving RUG members in this stage was that they would be participants who were representative of potential users of the software for discrete choice experiments and shared decision-making regarding OA medication in clinical practice.

All participants were diagnosed with OA and reported experiencing one or more of hip, knee, hand, or foot joint pain in the past 12 months. Twelve members of the RUG were contacted by telephone and invited to attend one group session. Available members were sent postal invitations, explaining the aims and agenda of the session. The final sample comprised 4 participants (2 female, 2 male).

The specific objectives were: a) to investigate the clarity of the ACBCA question formats; b) to determine the amount of information that participants needed to understand the ACBCA task and c) to investigate ways to improve the design and wording of the ACBCA task. In this phase of the study, the choices did not relate specifically to medication preferences as we had not yet developed these. A more general task was chosen that aligned with other research in the Centre and included 6 attributes and 15 levels relating to OA patients' preferences for consulting a general practitioner (GP).

Method

The ACBCA task was presented to the RUG on a laptop connected to a projector. A volunteer from the group completed the task while other group members watched the process *via* the projector. The volunteer was asked to discuss each question while completing the task. An open discussion between the volunteer, the remaining group members and the researchers, took place after each ACBCA screen. Structured probing questions were asked after each ACBCA screen. The probing questions were broad and general; for example, What do you understand by this screen?; How easy or difficult did you find completing this question?; How might this be improved?

Development phase for ACBCA medication task

ACBCA software (Sawtooth Software, SSI Web, version 8) was used to develop the discrete choice task. The process for constructing the task followed the protocol developed by Ryan and Farrar [1].

Stage 1 of this phase involved identification of the attributes and Stage 2 involved assigning levels to the attributes. For these 2 Stages, potential attributes and levels for inclusion were identified by a literature search. The final list was determined by discussion between members of the research team. Stage 3 involved the selection of choices to be made. In the ACBCA task, the choice of scenarios is defined by the software, based on participants' initial ratings of attributes and levels. The number of questions required for the ACBCA task depends on respondents' evaluation of the scenarios. On completion of the task, regression analyses (within the software package) were used to determine individual preference measures.

Second feasibility study

Background

Having established key design issues for an ACBCA task in feasibility Study 1 and the content, attributes and levels of the OA medication task in the development phase, the next phase (feasibility Study 2) involved a practical ACBCA experiment.

Method

Twelve members of the RUG were invited to participate. The final sample comprised 11 participants (7 female [64%], 4 male [36%]). None had taken part in the first feasibility Study.

Participants were invited individually to complete the ACBCA task on a computer in the computer laboratory at the Arthritis Research UK Primary Care Centre at Keele University, UK. Each respondent had a unique ID number and password to complete the task and the time that each participant took to complete the task was recorded.

Immediately after completion of the ACBCA task, each participant was asked to complete a feedback form about their experience. The form included 9 questions relating to the ACBCA task (See Table 1). Responses to the questions were in the form of a 5-point Likert scale (1 - strongly agree, 2 - agree, 3 - neither agree nor disagree, 4 - disagree and 5 - strongly disagree). Participants were then individually provided with feedback of the results generated by the ACBCA software regarding their personal preferences and were invited to discuss in a semi-structured interview format with the project researcher (BAO) the extent to which these results reflected their personal preferences.

Table 1 List of questions in the post task evaluation. Responses to the questions were in the form of a 5-point Likert scale (1 Strongly agree, 2 Agree, 3 Neither agree nor disagree, 4 Disagree and 5 Strongly disagree)

1. I found the first few screens on which I had to make choices about medications hard to understand.
2. After a few more of these screens I felt comfortable completing the questionnaire.
3. I found the questionnaire easy to read.
4. I found the questionnaire easy to understand.
5. I felt that the questionnaire was adjusting the questions according to my previous answers.
6. I enjoyed completing the questionnaire.
7. Completing the questionnaire helped me in making a decision about my preferences.
8. I prefer to use a pen and paper questionnaire.
9. I would be happy to complete a similar computerized questionnaire in the future.

Ethical statement

All participants in this project were members of the extended Patient and Public Involvement Group of the Arthritis Research UK Primary Care Centre at Keele University, UK. These members all signed an agreement to use their expertise in the development of research. The study complied with Keele University, UK guidelines for the storage of sensitive and confidential data on laptops.

Results

First feasibility study

The results of this study are presented in terms of the 3 issues outlined in the Methods section.

To determine the amount of information that participants needed to understand the ACBCA task. The RUG members reported that there was too much information on the screening question pages. For example, Respondent 3 stated:

> "The difficulty is keeping every one of those 6 factors in your head at the same time when also you've been given 3 different sets of circumstances. So, for example, you are looking at less pain and you think to yourself, well I wouldn't go to the doctor if I had less pain and then you say well there's a lot of information down here and you see a different GP and you go to that one, forgetting that you've decided beforehand that you wouldn't go down that column."

To investigate the clarity of the ACBCA question formats. The RUG respondents suggested that more information in the questions and fewer words in the scenarios representing the answers, could make the task easier to complete. For example, Respondent 1 stated:

> "It [is] just the question itself. It's [understanding] what are you getting at? We had it explained to us, but anybody else would need more information."

To investigate ways to improve the design and wording of the ACBCA task. The group discussion resulted in substantial changes to the style and presentation of the software-generated scenarios. Examples of these changes included: better and more substantial information in order to clearly explain the process; reduction in the volume of information on each screen and changes in the wording on screens. For example, Respondent 4 stated:

> "The instructions need to be a bit fuller, I think. For each one indicate whether it is a possibility or not by choosing from the 2 [options] at the bottom of each of the 4 columns. It could probably be simplified beyond that."

In conclusion, the RUG involvement in this session helped to shape the design and contents of the ACBCA task in preparation for the second feasibility study.

Table 2 List of sources of attributes assigned to the ACBCA task

Attributes in the review studies	**Study attributes (decisions with expert and patient groups)**
Label: Fraenkel *et al*., 2004 [4-6]	Availability
Route of administration: Fraenkel and Fried, 2008 [7]	Route of administration
Route of administration: Fraenkel *et al*., 2004 [4-6]	Frequency
Percentage of patients who benefit: Fraenkel *et al*., 2004 [4-6] Improved strength: Fraenkel and Fried, 2008 [7] Decrease in pain: Fraenkel and Fried, 2008 [7]	Expected percentage of benefit
Risk of ulcer: Fraenkel *et al*., 2004 [4-6]; Chang *et al*., 2005 [9] Fraenkel and Fried, 2008 [7]	Risk of gastric ulcer
Risk of serious side effects: Ratcliffe *et al*., 2004 [8]	Risk of addiction Risk of renal and liver impairment Risk of heart attacks and strokes

Table 3 The levels of the attributes and their sources

Attribute	**Levels**	**Source**
Availability	1. Prescription drug	Fraenkel *et al*., 2004 [4-6]
	2. Over-the-counter drug	Fraenkel *et al*., 2004 [4-6]
	3. Internet purchase drug	Discussions with expert and patient groups
Route of administration	1. Cream/Gel	Fraenkel and Fried, 2008 [7] & Fraenkel *et al*., 2004 [4-6]
	2. Oral	Fraenkel *et al*., 2004 [4-6]
Frequency	1. Once a day	Fraenkel *et al*., 2004 [4-6]
	2. Twice a day	Fraenkel *et al*., 2004 [4-6]
	3. 3-4 times a day	Fraenkel *et al*., 2004 [4-6]
	4. As needed	Discussions with expert and patient groups
Expected percentage of benefit	1. Expect 25% benefit	Fraenkel *et al*., 2004 [4-6]
	2. Expect 50% benefit	Fraenkel *et al*., 2004 [4-6]
	3. Expect 75% benefit	Fraenkel *et al*., 2004 [4-6]
Risk of gastric ulcer	1. No risk	Discussions with expert and patient groups
	2. Low risk	Discussions with expert and patient groups
	3. Moderate risk	Discussions with expert and patient groups
	4. High risk	Discussions with expert and patient groups
Risk of addiction	1. No risk	Discussions with expert and patient groups
	2. Low risk	Discussions with expert and patient groups
	3. Moderate risk	Discussions with expert and patient groups
	4. High risk	Discussions with expert and patient groups
Risk of kidney and liver impairment	1. No risk	Discussions with expert and patient groups
	2. Low risk	Discussions with expert and patient groups
	3. Moderate risk	Discussions with expert and patient groups
	4. High risk	Discussions with expert and patient groups
Risk of heart attacks and strokes	1. No risk	Discussions with expert and patient groups
	2. Low risk	Discussions with expert and patient groups
	3. Moderate risk	Discussions with expert and patient groups
	4. High risk	Discussions with expert and patient groups

Development phase

This was the outcome of a systematic review in which 5 previous studies of the use of CA in relation to OA patients' treatment preferences were identified [4-9,12]. The attributes identified by these studies were placed in 6 categories: 1. OA characteristics such as pain severity; 2. Treatment characteristics such as route of administration; 3. Treatment benefits; 4. Treatment complications; 5.

Route and frequency of administration and 6. Costs (cost was not included in our study among older UK patients because cost of medications for older persons in the UK healthcare system is rarely a direct issue). Based on the literature, discussions within the research team and feedback from RUG participants in the first feasibility Study, a list of attributes and levels was finalized (see Tables 2 and 3).

Second feasibility study

Eleven participants (4 male [36%] and 7 female [64%]) with OA in one or more of the hips, knees, shoulders, hands, ankles and spine took part in this study. All participants were over 50 years of age. Most (73%) had lived with OA for over 5 years. All participants reported that joint pain affected their normal life; 9 (82%) reported it affected them moderately to extremely. The participants reported using paracetamol (82%), NSAIDs and COX-2 inhibitors (82%), opioids (64%) and glucosamine (64%) for the management of OA as the most commonly used drugs.

All participants completed the ACBCA task. The mean time for completing the ACBCA task was 24 minutes, ranging from 12 to 48 minutes. The participant who completed the task in 48 minutes was an outlier (mean if excluded = 22 minutes) who reported specifically taking time to critically investigate the task while completing it.

Participants had diverse computer skills, ranging from people who did not use or possess a computer (n=2) to those who use a computer daily (n=4). There was no major difference in the mean task completion time between participants who did not have a computer and other participants (20.5 minutes and 24.7 minutes respectively). The 2 participants without a computer completed the task in 18 minutes and 23 minutes respectively. Furthermore, 2 participants who had never completed a computerized task in the past completed the ACBCA task in 23 and 24 minutes.

All participants completed the post-experiment survey (see Table 4). Nine participants disagreed or strongly disagreed that the first few screens were hard to understand (Question 1). Most participants (n=10) agreed or strongly agreed that they felt comfortable after completing a few screens (Question 2). None of the participants reported the ACBCA task to be hard to read or understand (Questions 3 and 4). Most participants (n=10) agreed that the task was adjusting to their individual responses as the task proceeded (Question 5). Most participants (n=10) agreed that the task helped in making decisions about preferences (Question 7). One participant said they would prefer pen and paper to the computer (Question 8). All participants agreed that they would be happy to complete a similar ACBCA task in the future (Question 9).

When asked in the semi-structured interviews whether the results of the task reflected their own preferences, 10 participants confirmed that this was the case. The remaining participant was not sure that the prediction of the attribute with the highest relative importance was accurate, but agreed with the other results.

Discussion

In reviewing the use of CA in health services research, Ryan and Farrar outlined a series of steps in constructing appropriate tasks [2]. They also noted that "methodological issues need further consideration". This study focused on the feasibility of using ACBCA. While ACBCA appears to combine the advantages of ACA and CBCA, it may result in a task that is too complex for respondents to complete. Earlier methods had not been able to include 8 attributes and while ACBCA theoretically could include this number of attributes, there had been no empirical evaluations of specific tasks. In our study, the focus was on the validity of an ACBCA task with 8 attributes. The first type of validity we examined was face validity: did the task appear to evaluate what it aimed to evaluate? This was addressed in the first feasibility Study through testing the wording and clarity of the questions and in the second feasibility study by participants' perception that the results of the task reflected their preferences. The second type of validity was content validity: did the task include an appropriate range of attributes and levels? This was attained through participants' involvement in finalizing the list of attributes and levels in the development phase. This study was not concerned with predictive validity (i.e., whether stated preferences in the discrete choice experiment were reflected in subsequent behaviour) or with reliability (i.e., the reproducibility of participants' responses in a separate occurrence of the experiment). While these are important concepts, they were beyond the scope of the present study [13]. Our measures of validity were dependent on self-report.

The first feasibility Study was conducted in a group format and identified strengths and limitations of the ACBCA task. Regarding the strengths, the consensus was that the ACBCA task did not require advanced computer skills. Rochon *et al*. [14] conducted a similar study aiming to understand elderly patients' experiences with the use of ACA to explore treatment options for OA. Their results suggest that elderly OA participants' low level of computer comfort is a significant contributor to the problematic challenge that participants faced when completing ACA task [14]. These results differ from the results of this study, which suggest that computer skills are not a requirement for completing an ACBCA questionnaire. There are various possible explanations for these discrepant findings. First, participants in Rochon *et al*. [14] reported that the ACA task did not adapt to the preferences they expressed during the questionnaire, as opposed to the participants in this project who reported that ACBCA task adapted to their expressed preferences accordingly. Second, the choice-based task is more favourable than the rating/ranking task [15]. Thus, participants feel more comfortable completing the ACBCA questionnaire than completing an ACA questionnaire.

Table 4 Results of the participants feedback regarding the ACBC task

Feedback from question	***Frequency (Percentage)***				
	Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
I found the first few screens on which I had to make choices about medications hard to understand	0 (0)	1 (9.1)	1 (9.1)	6 (54.5)	3 (27.3)
After a few more of these screens I felt comfortable completing the questionnaire	4 (36.4)	6 (54.5)	1 (9.1)	0 (0)	0 (0)
I found the questionnaire easy to read	7 (63.6)	3 (27.3)	1 (9.1)	0 (0)	0 (0)
I found the questionnaire easy to understand	5 (45.5)	5 (45.5)	1 (9.1)	0 (0)	0 (0)
I felt that the questionnaire was adjusting the questions according to my previous answers	6 (54.5)	4 (36.4)	1 (9.1)	0 (0)	0 (0)
I enjoyed completing the questionnaire	3 (27.3)	7 (63.6)	1 (9.1)	0 (0)	0 (0)
Completing the questionnaire helped me in making a decision about my preferences	5 (45.5)	3 (27.3)	3 (27.3)	0 (0)	0 (0)
I prefer to use a pen and paper questionnaire	0 (0)	1 (9.1)	5 (45.5)	4 (36.4)	1 (9.1)
I would be happy to complete a similar computerised questionnaire in the future	7 (63.6)	4 (36.4)	0 (0)	0 (0)	0 (0)

In another study investigating the feasibility and reliability of ACA as an assessment tool for individual patient preferences, 2 of the 50 participants completing a computerized ACA questionnaire started the exercise, but discontinued it because they found it too difficult [16]. The group also reported that the interactive element of the task resulted in a greater sense of involvement. The main limitations identified related to the construction of attributes and levels and the lack of clarity of the format of the questions. Following the first feasibility Study - which, as noted above, was limited to 6 attributes and did not focus on medication preferences - the OA medication task was developed and designed using the latest version of the ACBCA software (SSI Web 7.0.26). While this task incorporated the feedback from the first feasibility Study, it also involved a completely new task focused on medication preferences.

The results of the second feasibility Study indicate that 8 attributes and levels can be included in an ACBCA task on the pharmacological treatment of OA. While this paper does not present the results of the task (i.e., the actual values for attributes and levels), it establishes that 8 attributes can be incorporated into an ACBCA task. As 8 attributes have acceptable face validity, there is potential to develop an ACBCA task to include more attributes and test it the in the future. Thus, in the present task, only one attribute was concerned with medication benefit compared to 3 for medication risk. The benefit attributes could be split up further into various components (e.g., chance of benefit from the treatment and time to benefit) [4].

This study evaluated only one ACBCA task and further work is needed to examine different ACBCA tasks in healthcare settings. Green and Srinivasan [17] reported that several studies have demonstrated consistency of CA models in terms of reproducing current market conditions and customers preferences. To date, research on computer-based versions of CA indicate satisfactory validity, although this issue has not been analysed in depth (see http://www.conjointanalysis.net/CANet/Manuskripte/ValidityOCA.pdf).

The strengths of the feasibility study designs were that all participants were individuals with OA. They were taking part as members of a group that had an established mandate to be critical, but constructive participants in helping to develop robust research methods that would engage all types and backgrounds of future participants. They had particular experience in ensuring that the language of material presented to them was accessible and easy to follow and in highlighting anything in the research process that might be difficult to do or to understand. The RUG participant samples were different for feasibility Studies 1 and 2 to ensure independence of the 2 stages. The samples, although small, proved sufficient for the purposes of each study.

The limitations of our study include the fact that the second feasibility Study tested one particular set of attributes and levels in a controlled research environment with a group of interested participants and its generalizability to ACBCA experiments with different, larger attribute sets in a ‘real-life’ clinical context remains to be demonstrated. Testing of the validity of the individual outputs of the ACBCA experiment was limited in these studies to questionnaires and interviews; objective investigation of whether the outputs represent choices

made in practice (predictive validity) and of the usefulness of the outputs in supporting 'real-life' choices was beyond the scope of the studies. However, the studies have established both the feasibility of doing such experiments in this type and age group of patients and the method of developing feasible and practical ACBCA experiments through the engagement of patients in the development process. They have laid the basis for future research into the practical application of ACBCA experiments in describing and supporting treatment decisions made in real-life situations.

Although Ryan and Farrar [2] described the process of undertaking a CA study as occurring in 5 stages, they did not include patient involvement as an aspect in the construction of the attributes. Generally, patients have been involved in research as "subjects", but not as part of the research team [18]. In recent years, growing attention has been paid to engaging patients in research, but the level of involvement remains minor and this has important implications for the development of person-centered healthcare. Barber and colleagues [19] conducted a study investigating patients' involvement in 518 NHS research projects and found that only 17% of the researchers involved patients as members of the research group. One of the key strengths of this study is the involvement of the RUG in every step of the research development. The RUG members were involved in appraising the ACBCA design, evaluating the attributes and levels of the ACBCA task and testing the final version of the ACBA task.

Conclusion

In conclusion, there is little research into the validity and reliability of computerized or online versions of CA [20]. This study has highlighted that adequate face and measurement validity of an ACBCA task can be achieved through a developmental process taking account of participants' requirements. The involvement of participants during the design phase of the task enabled the research team to construct an ACBCA task that resulted in participants reporting that the task helped them to identify their medication preferences for the treatment of osteoarthritis. We advance our study as an important contribution to the person-centered healthcare literature.

Acknowledgements and Conflicts of Interest

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