Original article

Discrete-choice experiment to analyse preferences for centralizing specialist cancer surgery services

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Background: **Centralizing specialist cancer surgery services aims to reduce variations in quality of care and improve patient outcomes, but increases travel demands on patients and families. This study aimed to evaluate preferences of patients, health professionals and members of the public for the characteristics associated with centralization.**

Methods: **A discrete-choice experiment was conducted, using paper and electronic surveys. Participants comprised: former and current patients (at any stage of treatment) with prostate, bladder, kidney or oesophagogastric cancer who previously participated in the National Cancer Patient Experience Survey; health professionals with experience of cancer care (11 types including surgeons, nurses and oncologists); and members of the public. Choice scenarios were based on the following attributes: travel time to hospital, risk of serious complications, risk of death, annual number of operations at the centre, access to a specialist multidisciplinary team (MDT) and specialist surgeon cover after surgery.**

Results: **Responses were obtained from 444 individuals (206 patients, 111 health professionals and 127 members of the public). The response rate was 52·8 per cent for the patient sample; it was unknown for the other groups as the survey was distributed via multiple overlapping methods. Preferences were particularly influenced by risk of complications, risk of death and access to a specialist MDT. Participants were willing to travel, on average, 75 min longer in order to reduce their risk of complications by 1 per cent, and over 5 h longer to reduce risk of death by 1 per cent. Findings were similar across groups.**

Conclusion: **Respondents' preferences in this selected sample were consistent with centralization.**

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Introduction

Centralization of cancer surgical services is occurring in some parts of Europe, the USA and Canada[1–3]. In the UK, the importance of seeking new models of care, including centralization where appropriate, has been emphasized in *Five Year Forward View*[4]. There have been initiatives of this type in oesophagogastric cancer services[5–7]. The National Cancer Strategy is currently evaluating whether cancer surgery merits further centralization[8]. In London since 2011, and Greater Manchester since 2014, cancer care has been provided in 'integrated cancer systems', working towards centralization of specialist surgical pathways for prostate, bladder, kidney and oesophagogastric cancers. The rationale for centralizing specialist cancer surgery services is to reduce unacceptable variation in quality of care and outcomes achieved by different centres[9]. Higher volume might be associated with better outcomes for oesophagogastric[10], rectal[11] and urological[12,13] cancers. Centralizing other services can lead to better outcomes too[14–19].

There are several reasons why centralization may improve outcomes. Increased patient volume permits greater specialization, experience and expertise of staff[20]. Greater numbers of patients may allow equal access to innovative technologies[9,20]. On the other hand, many aspects of care are still likely to be provided by local hospitals, including diagnosis and ongoing chemotherapy, with only complex surgery or other interventions (such as brachytherapy) likely to be provided at the specialist centre[21]. After centralization, local hospitals may have closer involvement with specialist centre staff, for example via joint multidisciplinary team (MDT) meetings, with the potential to improve quality of care across the whole system[9,22]. One disadvantage of centralization is that it leads to increased travel demands, limiting access to high-quality care[23] and to support from family and friends.

The aim of this study was to examine preferences of patients, health professionals and the general public for the characteristics associated with centralizing specialist cancer surgery services in England, including the relative importance of different service characteristics and how preferences varied between groups.

Methods

Preferences were explored using a discrete-choice experiment (DCE)[24]. In DCEs, respondents are typically presented with a series of questions, asking them to choose between two or more alternatives that describe a service in terms of a set of characteristics (attributes). This allows the attributes of a service that respondents prefer to be evaluated, as well as the trade-off they are willing to make between attributes. These methods have been used to compare preferences between patients and doctors for the surgical management of oesophagogastric cancer[25].

Ethical approval for this study was granted by the Proportionate Review Sub-committee of the National Research Ethics Service Committee Yorkshire and the Humber – Leeds. DCE guidelines were followed for study design and analysis[24,26].

Sampling and recruitment

DCE responses were obtained from three groups: patients with prostate, bladder, kidney and oesophagogastric cancer (target sample size 200); health professionals involved in the care of patients with these types of cancer (100); and members of the public (individuals who have not experienced these 4 types of cancer and are not health professionals caring for patients with these types of cancer; 100). Data were collected by hard-copy postal questionnaires that were sent to patients, and online surveys (patients, public, health professionals).

The patient sample comprised people who had previously participated in the National Cancer Patient Experience Survey (www.ncpes.co.uk) and agreed to be involved in future research. The authors invited former and current patients with prostate, bladder, kidney and oesophagogastric cancers, some of whom may also have been diagnosed with other cancers. The aim was to recruit 50 patients from London, 50 from Greater Manchester and 100 from the rest of England. Health professionals with experience of caring for patients with these four types of cancer were recruited via the mailing lists of the British Association of Urological Surgeons, the Association of Upper Gastrointestinal Surgeons, the UK Oncology Nursing Society, the Bladder and Renal Cancer Clinical Studies Group, the Prostate Cancer Clinical Studies Group, the Psychosocial Oncology and Survivorship Clinical Studies Group, and the Contact, Help, Advise and Information Network; the RESPECT-21 (Reorganising specialist cancer surgery for the 21st century: a mixed methods evaluation) newsletter; and the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) North Thames and NIHR CLAHRC Greater Manchester newsletters. The public sample was recruited through a number of routes: the Patient Voices charity, 21 HealthWatch local groups (who represent the views of people who use health and social care services), the Patients' Association, the RESPECT-21 newsletter and Twitter account, and the Cancer52 charities.

Potential patient participants were sent a hard copy of the questionnaire by post, including information about the study that also explained what their participation would entail. They were invited to complete and return the enclosed questionnaire, and were told that by doing so they consented to take part in the study. They were told that they did not have to take part if they did not want to. For the public and health professionals, potential respondents were sent an e-mail inviting them to participate, containing a weblink to the online survey. When clicking on the weblink they were provided with study information, as above. They were asked to click to another webpage to access the survey, and were informed that by doing so they consented to take part in the study. They were also told that they did not have to take part if they did not want to.

Attributes and attribute levels

The attributes and levels used in the DCE describing the most relevant service characteristics and outcomes associated with centralization of specialist cancer surgery were identified in a two-stage process. First, a review of documents covering development, planning and implementation of the changes[9,21,22,27] was undertaken to

Table 1 Attributes and levels used in the discrete-choice experiment

Attribute	Level			
Travel time to hospital for surgery (min)	< 30	30–60	60–90	90–120
Risk of serious complications from surgery (%)	1	5	10	
Risk of death within 30 days of surgery (%)	0·5	1·5	2·5	
No. of operations carried out each year by centre for each type of cancer	10	50	100	
Access to MDT to decide treatment	Local MDT	Specialist MDT		
Availability of specialist surgeon cover after operation	During normal working hours	Specialist surgeon 24/7		

MDT, multidisciplinary team; 24/7, 24 h a day, 7 days a week.

Factors	Centre A	Centre B
Travel time to the hospital to have surgery (door to door, one way)	Up to 30 minutes	Between 60 and 90 minutes
Risk of serious complications from surgery	5% chance of serious complications	1% chance of serious complications
Number of operations the centre carries out each year for each type of cancer	10 operations per centre per year	50 operations per centre per year
Risk of death within 30 days of surgery	2·5% chance of dying	1·5% chance of dying
Access to a specialist multidisciplinary team to decide treatment	Local MDT	Specialist MDT
Availability of specialist surgeon cover after the operation	Specialist surgeon during normal working hours and general surgeon for the rest of the time	Specialist surgeon 24 hours a day, 7 days a week

Which centre would you choose for surgery? (Tick one box only.)

Centre A ☐ Centre B ☐

Fig. 1 Example of discrete-choice experiment choice set. MDT, multidisciplinary team

determine characteristics of the care pathway and outcomes that could vary as a result of the proposed changes. A list of items was derived (*Appendix S1*, supporting information), and then a questionnaire was developed to determine the factors that were important to patients, carers and health professionals. Respondents were asked to state whether each item was important from their point of view, with 'yes' or 'no' as possible answers, and to rank the items by order of importance. They were also asked to add any items important to them that were not included in the list. A convenience sampling approach was used; 52 responses were received from 19 members of Patient and Public Involvement (PPI) groups comprising patients with cancer and carers, and 33 responses from health professionals.

Analysis of the information from the planning documents and responses from the questionnaires identified six attributes most likely to be important to respondents and likely to change as a result of centralizing specialist cancer surgery services: travel time to hospital, risk of serious complications from surgery, risk of death within 30 days of surgery, number of operations the centre carries out each year, access to a MDT and availability of specialist surgeon cover after the operation (*Table 1*). The levels of each attribute were based on planning documents covering development, planning and implementation of the changes (as above) and input from the RESPECT-21 Research Strategy Group, which included relevant clinical experts and patient representatives. Descriptions were developed for each of the attributes to help participants understand the nature of each attribute that they were being asked to consider (see complete questionnaire in *Appendix S2*, supporting information).

Questionnaire design

In the DCE, respondents were asked to choose their preferred option from a series of pairwise choices, that is in which of two fictitious centres would they prefer to have surgery, or, in the case of health professionals, they would prefer their patients to have surgery. Each centre was described by a unique combination of different levels of the attributes; *Fig. 1* shows an example of a DCE question. An opt-out or 'neither' option was not included as people at this stage of the cancer pathway are unlikely

Table 2 Demographic characteristics by group

	Patients (*n* = 199)	Health professionals (*n* = 109)	General public (*n* = 125)
Age (years)*	69(9)	48(8)	46(16)
Sex ratio (F : M)	41 : 158	45 : 64	85 : 40
Ethnicity – white	186 (93·5)	87 (79·8)	107 (85·6)
Cancer diagnosis			
Prostate	67 (33·7)	1 (0·9)	2 (1·6)
Bladder	61 (30·7)	0 (0)	0 (0)
Kidney	46 (23·1)	0 (0)	2 (1·6)
Oesophagus and stomach	38 (19·1)	2 (1·8)	0 (0)
Other type	17 (8·5)	5 (4·6)	19 (15·2)
Time of diagnosis			
This year	0 (0)	1 (0·9)	5 (4·0)
Last year	107 (53·8)	2 (1·8)	6 (4·8)
≥ 2 years ago	79 (39·7)	4 (3·7)	16 (12·8)
Current stage of treatment			
Waiting for decision	4 (2·0)	0 (0)	0 (0)
Scheduled for surgery	0 (0)	0 (0)	1 (0·8)
Scheduled for other treatment	4 (2·0)	0 (0)	0 (0)
Already had surgery	115 (57·8)	5 (4·6)	17 (13·6)
Already had other treatment	64 (32·2)	4 (3·7)	9 (7·2)
Family/friend with cancer diagnosis	97 (48·7)	45 (41·3)	66 (52·8)
Educational qualifications			
No formal qualifications	43 (21·6)		1 (0·8)
Lower than degree	87 (43·7)		20 (16·0)
Degree or higher degree	44 (22·1)		100 (80·0)
Employment status			
Full-time employed	26 (13·1)		59 (47·2)
Retired	135 (67·8)		30 (24·0)
Other	32 (16·1)		33 (26·4)
Health professional specialty			
Surgeon		61 (56·0)	
Oncologist		6 (5·5)	
Radiologist		1 (0·9)	
Physiotherapist		1 (0·9)	
Pathologist		1 (0·9)	
Occupational therapist		1 (0·9)	
Speech and language therapist		3 (2·8)	
Psychologist		1 (0·9)	
Dietician		5 (4·6)	
Nurse		22 (20·2)	
Other		6 (5·5)	
Place of residence			
London	39 (19·6)	27 (24·8)	63 (50·4)
Manchester	50 (25·1)	14 (12·8)	8 (6·4)
Other location	103 (51·8)	65 (59·6)	52 (41·6)

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). Data were incomplete for some variables.

to choose not to have surgery from one of the available options.

The number of potential combinations of attributes with two two-level attributes, three three-level attributes and one four-level attribute is 432 ($2^2 \times 3^3 \times 4^1$). With two options to choose from in each choice question, this gives a possible 186 192 choices (432 × 431). To reduce the number of choices to a manageable number, a fractional design was applied using the –dcreate– command in Stata[28], which creates efficient designs for DCEs using the modified Fedorov algorithm[29]. The choice set was reduced to 16 scenarios, which were split into two blocks of eight, and half the respondents in each group were assigned to each block. Overall, six versions of the DCE questionnaire were used: two for patients, two for health professionals and two for the general public.

The questionnaire also included a question asking respondents to rank the six attributes according to their overall importance, from 1 (most important) to 6 (least important). Information on demographic, socioeconomic and cancer-related experience was also collected (*Appendix S2*, supporting information).

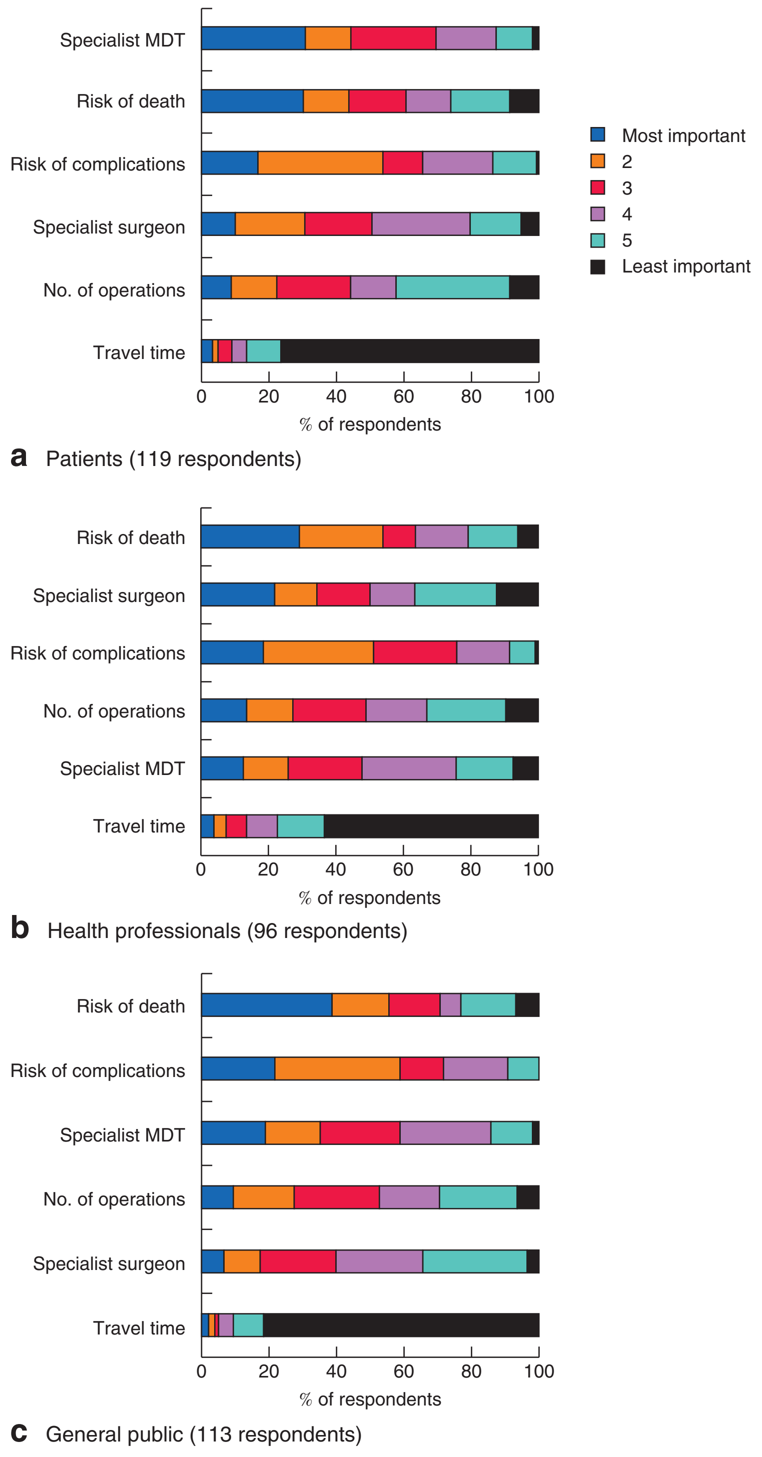

Fig. 2 Ranking of attributes by group: **a** patients, **b** health professionals and **c** general public. MDT, multidisciplinary team

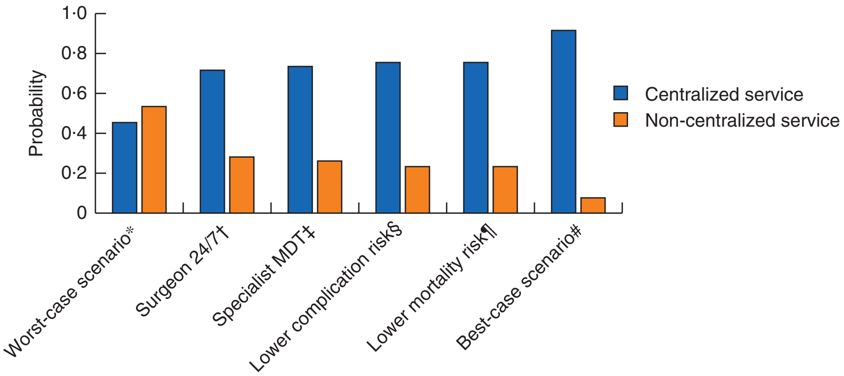

Fig. 3 Predicted probabilities of choosing centralized cancer surgery services. Non-centralized service (comparator): 30 min travel time, ten operations per year, no access to specialist multidisciplinary team (MDT), specialist surgeon cover during normal hours only, 5 per cent risk of complication and 1·5 per cent risk of death; *worst-case scenario: centralized service with 120 min travel time, 100 operations per year, no access to specialist MDT, specialist surgeon cover during normal hours only, 5 per cent risk of complication and 1·5 per cent risk of death; †surgeon 24/7: centralized service with 120 min travel time, 100 operations per year, no access to specialist MDT, specialist surgeon cover 24 h a day/7 days a week, 5 per cent risk of complication and 1·5 per cent risk of death; ‡specialist MDT: centralized service with 120 min travel time, 100 operations per year, access to specialist MDT, specialist surgeon cover during normal hours only, 5 per cent risk of complication and 1·5 per cent risk of death; §lower complication risk: centralized service with 120 min travel time, 100 operations per year, no access to specialist MDT, specialist surgeon cover during normal hours only, 1 per cent risk of complication and 1·5 per cent risk of death; ¶lower mortality risk: centralized service with 120 min travel time, 100 operations per year, no access to specialist MDT, specialist surgeon cover during normal hours only, 5 per cent risk of complication and 0·5 per cent risk of death; #best-case scenario: centralized service with 120 min travel time, 100 operations per year, access to specialist MDT, specialist surgeon cover 24 h a day/7 days a week, 1 per cent risk of complication and 0·5 per cent risk of death.

The questionnaire was checked for the use of plain English by the Plain English Campaign and piloted by ten PPI representatives in London Cancer and Greater Manchester Cancer. This resulted in minor improvements being made to the wording of the questionnaire.

Data analysis

Descriptive statistics for the characteristics of participants who completed the questionnaire were computed. Responses to the ranking questions are presented graphically. Inter-rater agreement was measured using κ statistics[30].

The DCE data were analysed using a conditional logit regression model in which the outcome was centre preference (A or B) and the variables in the equation were the individual attributes. A constant term was not included. The model was run on the whole sample, as well as with participants stratified by the three groups. Differences in preferences between the groups were tested by comparing the coefficients for each group using χ^2 tests.

The travel time attribute was initially included using a categorical specification with four categories (up to 30 min, 30–60 min, 60–90 min, 90–120 min). This specification yielded a non-significant effect for each individual category, but the joint effect across all categories was found to be significant (*Appendix S3*, supporting information). This variable was therefore also included as a continuous variable, taking the higher-end value of each interval (30, 60, 90 and 120 min). The same results were obtained when alternative values were used (mid- or lower-end value), provided the interval between values was preserved.

This specification of the travel time attribute also allowed marginal rates of substitution (MRS) with respect to this variable to be computed. The MRS allows direct assessment of how much of one attribute participants are willing to trade for one unit of another attribute, and therefore enables a comparison of different attributes on a common scale. Following the transformation of the travel time attribute into a continuous measure, MRS values were calculated using the travel time to hospital attribute as the denominator so that participants' preferences and the trade-offs could be compared on a common value scale in terms of willingness to travel.

In addition, regression analysis results were used to calculate the predicted probabilities of choosing cancer surgical services with attribute levels corresponding to the goals of centralization, compared with a non-centralized service. Specifically, the probability that a respondent would choose a hypothetical non-centralized service was

Table 3 Conditional logit regression analysis by group

	Coefficient			
	Patients ($n = 199$)	Health professionals ($n = 109$)	General public ($n = 125$)	P†
No. of observations	3124	1708	2002	
Travel time to hospital for surgery (min)	−0·003 (−0·005, −0·000)	−0·003 (−0·006, 0·001)*	0·0003 (−0·003, 0·003)*	0·281
Risk of serious complications from surgery (%)	−0·113 (−0·136, −0·090)	−0·129 (−0·159, −0·100)	−0·172 (−0·210, −0·134)	0·037
Risk of death within 30 days of surgery (%)	−0·498 (−0·602, −0·395)	−0·511 (−0·654, −0·369)	−0·668 (−0·806, −0·530)	0·131
No. of operations carried out each year by centre for each type of cancer	0·009 (0·007, 0·011)	0·009 (0·006, 0·012)	0·008 (0·006, 0·011)	0·923
Access to MDT to decide treatment				
Local MDT	–	–	–	
Specialist MDT	0·377 (0·243, 0·511)	0·371 (0·222, 0·520)	0·535 (0·324, 0·746)	0·401
Availability of specialist surgeon cover after operation				
During normal working hours	–	–	–	
24/7	0·346 (0·213, 0·478)	0·232 (0·073, 0·392)	0·354 (0·165, 0·542)	0·498

Values in parentheses are 95 per cent confidence intervals. MDT, multidisciplinary team; 24/7, 24 h a day, 7 days a week. *Coefficient not significantly different from 0; all other coefficients significant at $P < 0{\cdot}050$. †χ^2 test.

compared against various different centralized service scenarios. The hypothetical non-centralized service was defined as: 30 min travel time, ten operations carried out per year at the centre (for both attributes these were the lowest levels included in the study), no access to a specialist MDT, specialist surgeon cover during normal hours only, a 5 per cent risk of complication and a 1·5 per cent risk of death. In each 'centralized' scenario, the travel time was fixed at 120 min, the number of operations at the centre was increased to 100 per year (the highest level included in the study), and the following potential characteristics of a centralized service were added individually and then jointly: access to a specialist MDT, access to specialist surgeon cover 24 h a day, 7 days a week (24/7), risk of complications reduced to 1 per cent, and risk of death reduced to 0·5 per cent.

All analyses were undertaken using the software package Stata® version 12.0 (StataCorp, College Station, Texas, USA).

Results

In total, 444 responses were received from July to November 2016, 206 from patients, 111 from health professionals and 127 from members of the public. DCE questions were completed in full by 199 patients, 109 health professionals and 125 members of the public. The response rate was 52·8 per cent for the patient sample; it was not possible to estimate a response rate for the other groups as the survey was sent via multiple overlapping distribution routes using convenience sampling and snowball sampling techniques. The analysis was a complete-case analysis using only these respondents' answers.

Of 199 patients, 41 were women (20·6 per cent), compared with 45 (41·3 per cent) of the sample of health professionals and 85 (68·0 per cent) of the general public sample (*Table 2*). Mean ages were 69, 48 and 46 years respectively. Among patients, the most common type of cancer in the sample was prostate cancer (which explained the imbalance of sexes in the patient sample), followed by bladder cancer; most patients were diagnosed during the year before the survey and had already undergone surgery. Forty-three patients (21·6 per cent) had no formal qualifications and 44 (22·1 per cent) had a degree; 135 patients (67·8 per cent) were retired at the time of the survey. In the health professionals' sample, 61 (56·0 per cent) were surgeons and 22 (20·2 per cent) were nurses. In the general public sample, most respondents had a degree and were working full time. In all three groups there was a mix of respondents from London, Greater Manchester and the rest of England.

Simple attribute ranking

The responses to the ranking question posed before the DCE questions were examined. Only 328 respondents (119 patients, 96 health professionals and 113 members of the public) provided full responses to this question. *Fig. 2* shows the responses for each of the three groups separately. Attributes were ranked by likelihood of being selected as the most important factor. The κ statistic overall was 0·1166; it was 0·0765, 0·1268 and 0·1501 for health professionals, patients and the general public respectively, representing slight agreement among rankers in each case[31].

Using this method of ranking, risk of death and risk of complications were ranked highly in each sample, and travel time was consistently considered to be the least important factor by each group. Some differences between groups were noted: patients appeared to consider the availability of a specialist MDT team highly important,

Table 4 Conditional logit analysis regression results for total sample

	Coefficient	Willingness to travel to hospital (min)*
Travel time to hospital for surgery (min)	−0·002 (−0·003, −0·0002)	–
Risk of serious complications from surgery (%)	−0·132 (−0·149, −0·116)	75
Risk of death within 30 days of surgery (%)	−0·544 (−0·615, −0·473)	307
No. of operations carried out each year by centre for each type of cancer	0·009 (0·007, 0·010)	−5
Access to MDT to decide treatment		
Local MDT	–	–
Specialist MDT	0·414 (0·322, 0·507)	−234
Availability of specialist surgeon cover after operation		
During normal working hours	–	
24/7	0·308 (0·219, 0·397)	−174

Values in parentheses are 95 per cent confidence intervals. The data are based on 6834 observations among 433 respondents. *Marginal rates of substitution (MRS) computed by dividing each coefficient by the coefficient for travel time to hospital. The coefficients presented are rounded and therefore MRS values are not identical to the ratio of the coefficients shown in the table. MDT, multidisciplinary team; 24/7, 24 h a day, 7 days a week.

whereas health professionals considered the availability of a specialist surgeon 24/7 more important (note that 56·0 per cent of the healthcare professionals' sample were surgeons).

Discrete-choice experiment analysis

There were no statistically significant differences in the effects of the attributes between groups, with the exception of the risk of complications, which had a slightly larger impact in the public sample compared with the patient sample (*Table 3*). Therefore, the study focused on the model conducted on the whole sample (*Table 4*).

As expected, individuals preferred to have surgery in a centre with better attribute levels: requiring shorter travel time, where the risk of complications and the risk of death were lower, the number of operations carried out each year was larger, and where there was access to a specialist MDT and to specialist surgeon cover 24/7. The MRS showed the relative importance of each attribute by enabling the comparison of different attributes on a common scale. Participants were willing to travel 75 min longer in order to reduce the risk of complications by 1 per cent, and over 5 h longer to reduce their risk of death after surgery by 1 per cent. Their willingness to travel increased by 5 min for every additional procedure carried out by the centre each year, and by approximately 4 h to have access to a specialist MDT team and 3 h for 24/7 access to specialist surgeon cover. These MRS values reflected the ranking shown in *Fig*. *2*, in particular the relatively lower importance of travel time.

The probability that respondents would choose a centre with attribute levels corresponding to a centralized service compared with a non-centralized service is shown in *Fig*. *3*. Compared with a centre requiring 30 min travel time and which carries out ten operations a year (a generic non-centralized service), respondents were less likely to choose a centre that carries out 100 operations a year but for which the travel time increases to 120 min, holding the rest of the attributes constant (a centralized service where the only difference compared with a non-centralized service is in terms of travel burden and number of operations; worst-case scenario in *Fig*. *3*). However, the probability that respondents would choose the centralized service increased if the centre achieved the goals of centralization with respect to each of the other attributes: the probability was 72 per cent if the centre provides access to specialist surgeon cover 24/7, 74 per cent if there is access to a specialist MDT, 76 per cent if the risk of complications is reduced from 5 to 1 per cent, and 76 per cent if the risk of death is reduced from 1·5 to 0·5 per cent. If the centralized service achieved all of these changes in the attributes, at the expense of increasing travel time from 30 to 120 min (best-case scenario in *Fig*. *3*), the probability that respondents would prefer to have surgery in the centralized centre reached 92 per cent.

Further subgroup analyses were undertaken, stratifying the whole sample by age (below 60 years *versus* 60 years or older), sex and place of residence (London, Greater Manchester and the rest of England). No consistent differences were observed. These variables were also included as control variables in the main model, but the control variables were found to be non-significant and the sign and significance of the attributes remained unchanged.

Discussion

Patients, health professionals and the public all preferred shorter travel times, lower risks of death and complications, and access to centres carrying out more operations, with more specialized teams and surgeons. Preferences were particularly influenced by the risk of complications, the risk of death and access to a specialist MDT. Travel time was the least important factor. Preferences were found to be consistent with the goals of centralization.

The probability that participants would choose to have surgery in a centre successfully meeting the aims of centralization was high. However, the impact on mortality and complications assumed in this best-case scenario was hypothetical, and might not be achieved. It was also found that, if centralization increased travel time for surgery at a hospital carrying out a larger number of operations in a year, but did not improve access to a specialist MDT or specialist surgeon cover 24/7, and did not reduce the risk of death and/or complications, then participants would prefer to have surgery in a non-centralized centre. Therefore, achieving outcomes associated with higher volumes is crucial.

Several limitations are acknowledged. DCEs elicit hypothetical choices, and therefore might lack external validity if individuals do not make the same choices in real-life situations. Some aspects of the choices might be difficult for respondents to understand, such as probabilities and clinical concepts. The representativeness of the samples used might be limited by the recruitment strategies, yielding potential sampling bias. The findings are unlikely to be generalizable to less urban areas where travel distances may be longer, or to countries where travel distances are considerably larger. There might be other factors affected by centralization that are important but were not included in the present analysis; they could not be included because the number of attributes/levels was predefined. Another limitation is that preferences for specific specialist cancer surgery services were analysed, and these preferences might be different for other types of cancer. For example, for some cancers the risk of death and complications is low, and in this case the importance of other attributes, including travel time, may be more pronounced. Travel costs, which might have a different effect on individual's preferences compared with travel time, were not assessed. Furthermore, the importance of travel time for surgery might be more important for family members than patients because they might travel more frequently. Analyses based on respondents who did, or did not have friends and relatives diagnosed with cancer showed that travel time only affected preferences among those with a family member (or close friend) with cancer.

The findings of this study highlight that people are willing to trade travel time for better outcomes and quality of care, in line with policy documents emphasizing the need to centralize specialist care[1]. It is important to note that this relates to surgery for the specified types of cancer and does not necessarily apply to other treatments (such as chemotherapy), which may be provided at local hospitals, or to other types of cancer. Planners who are redesigning services might consider, measure and communicate the impact of reorganization on the factors identified in this study.

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